

Permeability of small weirs for upstream fish passage

Summary

River fragmentation is a serious threat to the sustainability of fish populations. Although far more numerous than dams, the impact of small weirs on fish migration have received less attention, for being considered permeable to fish movements. Nevertheless, the presence of small weirs may cause successive losses of connectivity by partially or totally blocking migratory routes. Potamodromous cyprinids are particularly impacted due to their need of undergoing seasonal upstream migrations. The goal of this thesis was to assess the effects of small weirs, particularly broad-crested and low-head ramped weirs, which are the most frequent designs in Iberian watercourses, on behaviour and passage performance of potamodromous cyprinids.

A field assessment was performed to understand how these obstacles may affect, in an otherwise non-impacted stream, the movements of cyprinids. In addition to this field study, laboratorial experiments were carried out in an indoor flume. In these experiments, the influence of key hydraulic parameters – plunge pool depth, waterfall height, and weir crest width, in the case of broad-crested weirs; ramp length, and slope, for low-head ramped weirs, on passage performance of fish was tested across a range of discharges.

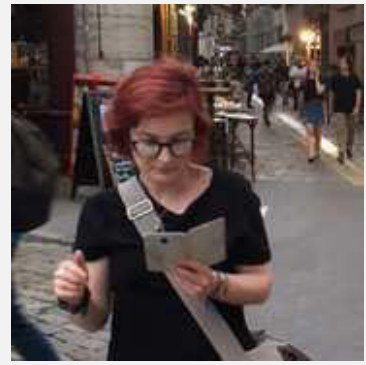
Iberian barbel (*Luciobarbus bocagei*) was selected as target species. Main results suggest that barbel may cease to migrate, when suitable habitats exist between barriers. Regarding broad-crested weirs, it was found that i) fish passage was inhibited by shallow plunge pool depths in association with high waterfall heights; ii) passage behavior was dependent on combinations of plunge pool depths and waterfall heights; and iii) the width of the crest influenced downstream passages but not upstream ones. For ramped weirs, i) negotiation was conditioned by the increase of slope and ramp length; and ii) retrofitting ramped weirs with natural substrates like cobbles may increase permeability to fish movements. These outcomes are useful to identify potential migration obstacles and to help design more permeable structures to fish movements.

Keywords

Ecohydraulics, river connectivity, potamodromous cyprinids species, migratory movements, small weirs.



Evaluation of the effect of small dams on the movements of potamodromous cyprinid species: Experimental tests with small weirs with vertical faces (above); and tests with ramped weirs (below).



PhD student

Susana Cristina Amador Dias Amaral

PhD program

River Restoration and Management (IST, University of Lisbon)

Supervisor

Antonio Pinheiro (CERIS, IST, University of Lisbon)

Co-supervisors

José Maria Santos (CEF, ISA, University of Lisbon) and Maria Teresa Ferreira (CEF, ISA, University of Lisbon)

Period

2014-2020

Funding

FCT scholarship (SFRH/BD/110562/2015) and University of Lisbon / Santander Totta (SantTotta/BD/RG2/SA/2011)