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Fish passage and behaviour through a temporary tidal weir

Carlos Alexandre[1], Roberto Oliveira[1], Sergio Bedmar[1], Sílvia Pedro[1], Bernardo Quintella[1,2], Pedro Almeida[1]

[1]Universidade de Évora, Portugal. [2]Universidade de Lisboa, Portugal

Abstract

Tidal weirs are a common solution to prevent saline wedge progression into freshwater systems. However, being in a transitional area between salt and fresh water, they can be severely detrimental for the successful migration of species that are highly dependent on the connectivity between these adjacent systems to complete their life cycle, the diadromous fish. The temporary weir of Rio Novo do Príncipe is a 3-meter-high structure, made from wooden boards and earth, which is annually built in the brackish section of Vouga river, Central Portugal, 2-3 km upstream from Ria de Aveiro Lagoon, a brackish waterbody flowing to the Atlantic. The weir is on place from May to October, to prevent saltwater from reaching upstream freshwater abstraction for industry and agriculture. In 2019, a fishway prototype was added to the weir, and a monitoring program is ongoing to study fish behaviour when reaching and negotiating the passage through this obstacle. This study uses an underwater acoustic camera (ARIS Sonar) to evaluate fish behaviour and movements. Since 2019, monitoring has been conducted weekly or fortnightly during the operation period of the weir (24h periods, 12h downstream + 12h upstream), considering all moon phases and tidal periods. Number of fish (e.g., grey mullets and sand smelts) successfully using the fishway, in each monitoring session, varied between 94 and 1860 in 2019, and 10 and 2357 in 2020, depending on environmental conditions. GLM model showed that variables such as tide level, salinity and moon phase are the main drivers of fish accumulation and movements through the fishway. Compatibilization between saline wedge contention and successful fish migration can be challenging. Results from this study provide insights on fish behaviour when facing obstacles and can help to promote the optimization of fish pass solutions in tidal areas.

Keywords

Tidal barriers, Migratory fish, Fish passage, ARIS sonar