Combining an innovative monitoring method and a hierarchical bayesian model to estimate diadromous fish run

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Abstract

Over decades, diadromous fish have strongly declined and many species are now protected through national and international regulations. They account for less than 1% of worldwide fish species; however they are one of the most tangible linkage between freshwater and marine ecosystems, and can reveal changes in the functioning of both ecosystems. Juvenile and adult migrations are key transitions of their life cycle, during which the abundance estimates is of critical interest for managing the populations. Fish counting facilities such as traps, video or resistivity counters, have been installed for decades on many rivers to provide abundance time series. However, the number of fish counted does not necessarily reveal real fish run (limited coverage, detection efficiency dependent on turbidity,...). Here we propose a two-step approach to assess the efficiency of fish counting facilities and to estimate diadromous run in streams. First, an acoustic camera (ARIS) is implemented in complement of the current counting facility during a short period of the fish run. Secondly, the acoustic data produced and the usual fish counts are analyzed jointly thanks to a hierarchical Bayesian model to estimate detection efficiencies. To that end, a generalist model has been developed and can be applied to various species and counting systems. Simulated data were used to test the model robustness. The approach was then performed in the Touques River (France) to estimate the silver eel run. The relevance of this approach and its potential transfer to managers is discussed.

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