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Fish habitat regression under water scarcity scenarios in the Douro River basin

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Climate change will predictably alter hydrological patterns and processes at the catchment scale, with impacts on habitat conditions for fish. The main goals of this study are to identify the stream reaches that will undergo more pronounced flow reduction under different climate change scenarios and to assess which fish species will be more affected by the consequent regression of suitable habitats. The interplay between changes in flow and temperature and the presence of transversal artificial obstacles (dams and weirs) is analysed. The results will contribute to river management and impact mitigation actions under climate change.
This study was carried out in the Tâmega catchment of the Douro basin. A set of 29 Hydrological, climatic, and hydrogeomorphological variables were modelled using a water modelling system (MOHID), based on meteorological data recorded monthly between 2008 and 2014. The same variables were modelled considering future climate change scenarios. The resulting variables were used in empirical habitat models of a set of key species (brown trout Salmo trutta fario, barbell Barbus bocagei, and nase Pseudochondrostoma duriense) using boosted regression trees. The stream segments between tributaries were used as spatial sampling units. Models were developed for the whole Douro basin using 401 fish sampling sites, although the modelled probabilities of species occurrence for each stream segment were predicted only for the Tâmega catchment. These probabilities of occurrence were used to classify stream segments into suitable and unsuitable habitat for each fish species, considering the future climate change scenario. The stream reaches that were predicted to undergo longer flow interruptions were identified and crossed with the resulting predictive maps of habitat suitability to compute the total area of habitat loss per species.
Among the target species, the brown trout was predicted to be the most sensitive to habitat regression due to the interplay of flow reduction, increase of temperature and transversal barriers. This species is therefore a good indicator of climate change impacts in rivers and therefore we recommend using this species as a target of monitoring programs to be implemented in the context of climate change adaptation strategies.