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Abstract

Suitability Models at Mesohabitat Scale of Native Freshwater Fish and Mussels for Their Application in Environmental Flows Assessment in the NE of the Iberian Peninsula †

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Abstract: In Mediterranean streams and rivers in general, aquatic organisms use a specific habitat for rearing, growing, breeding, and wintering. Multiple studies have focused on this subject, but few for the specific purpose of developing suitability models that feed hydrobiological models for the analysis of flow regimes and the design of environmental flows. Therefore, this study analyzes the habitat preferences of five freshwater species of fish and mussels in the NE of the Iberian Peninsula for that purpose. We use simple decision trees and random forest (RF), a machine learning technique based on the aggregation of multiple decision trees, to develop suitability models that relate the habitat preferences of the five species—separately adults and juveniles—to different attributes of a physical habitat at the meso-scale. Selected attributes are the surface percentage of different levels of depth (0–15 cm, 15–30 cm, . . . , >120 cm), velocity (0–15 cm/s, 15–30 cm/s, . . . , >120 cm/s) and abiotic/biotic substrate (e.g., gigalithal, megalithal, detritus, phytal), and absence/presence of refuges (boulder, canopy shading, emerging vegetation, undercut banks, woody debris, roots). The models were developed in order to predict three ranks of habitat suitability: absence, presence and abundance, depending on the mentioned attributes of the mesohabitat analysed. Our study provides quantitative results concerning the correspondence between the presence and abundance of different species and habitat characteristics, confirming qualitative observations stated in previous studies. We proved now that the adult mussels of *Unio* genus require a minimum of 5% of sand or silt, low velocities, and undercut banks and roots; that *Barbus meridionalis* habitat changes considerably among seasons; that *Salaria fluviatilis* needs coarse substrates (megalithal, macrolithal and mesolithal) and velocities above 15 cm/s; and that the adult *Squalius laietanus* prefers glides and pools with depths above 60 cm and velocities below 45 cm/s, depending on the season; and that *Anguilla anguilla* prefers intermediate size substrates (macrolithal, mesolithal and microlithal). These results are essential for the modeling of environmental flows in rivers where these species are present. Thus, by analyzing how their physical habitat changes according to the flow regime, one can see whether the available habitat of fish and mussels increases or decreases and predict periods of danger for the species.

Keywords: environmental flows; freshwater bivalves; freshwater fish; Mediterranean streams; mesohabitat scale; random forest; rivers; suitability models

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