Habitat modeling for brown trout population in alpine region of Slovenia with focus on determination of preference functions, fuzzy rules and fuzzy sets

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Water withdrawals and consequently reduction of discharges in river streams for different water uses (hydro power, irrigation, etc.) usually impoverish habitat suitability for naturally present river fish fauna. In Slovenia reduction of suitable habitats resulting from water abstractions frequently impacts local brown trout (Salmo truta) populations. This is the reason for establishment of habitat modeling which can qualitatively and quantitatively support decision making for determination of the environmental flow and other mitigation measures. Paper introduces applied methodology for habitat modeling where input data preparation and elaboration with required accuracy has to be considered. For model development four (4) representative and heterogeneous sampling sites were chosen. Two (2) sampling sections were located within the sections with small hydropower plants and were considered as sections affected by water abstractions. The other two (2) sampling sections were chosen where there are no existing water abstractions. Precise bathymetric mapping for chosen river sections has been performed. Topographic data and series of discharge and water level measurements enabled establishment of calibrated hydraulic models, which provide data on water velocities and depths for analyzed discharges. Brief field measurements were also performed to gather required data on dominant and subdominant substrate size and cover type. Since the accuracy of fish distribution on small scale is very important for habitat modeling, a fish sampling method had to be selected and modified for existing river microhabitats. The brown trout specimen's locations were collected with two (2) different sampling methods. A method of riverbank observation which is suitable for adult fish in pools and a method of electro fishing for locating small fish and fish in riffles or hiding in cover. Ecological and habitat requirements for fish species vary regarding different fish populations as well as eco and hydro morphological types of streams. Therefore, if habitat modeling for brown trout in Slovenia should be applied, it is necessary to determine preference requirements for the locally present brown trout populations. For efficient determination of applied preference functions and linked fuzzy sets/rules, beside expert determination, calibration according to field sampling must also be performed. After this final step a model is prepared for the analysis to support decision making in the field of environmental flow and other mitigation measures determination.