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Abstract

Fish Community Size Structure as an Indicator for the Bioassessment of Weir Impact †

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Abstract: The ecological impacts of large dams on stream fish communities have been largely documented, but there is less research on the impacts of small hydropower plants (hereafter called weirs). Most of the studies that evaluate the impact of weirs have been focused on taxonomical approaches such as species richness or diversity. Size-based indicators can be used as alternative tools to evaluate the effects of several environmental changes and anthropogenic perturbations on riverine ecosystems because of the key role of body size in fish physiological rates (i.e., growth, reproduction, respiration). This work investigated the impact of 16 weirs of the upper Ter River basin (NE Iberian Peninsula) on fish community body size structure, comparing control reaches (distant from a weir) with reaches impacted by weirs (immediately downstream). We also controlled for the influence of environmental factors including altitudinal gradients, spatial connectivity, and stream depth. Additionally, we tested the usage of multiple size-based approaches under different sampling intensities from one pass to four passes with an electrofishing sampling design. The results revealed strong evidence that weirs have a negative effect on basic size metrics such as average length and median length: fish communities located in impacted sites showed smaller average and median body sizes than fish communities distant from weirs. In contrast, the size spectrum parameters and functional size diversity metrics showed weak responses to the impact of weirs. The results also showed that all size-based metrics exhibited consistent results under different sampling efforts, suggesting that one sampling pass provided a good representation of the community size structure. The results suggested that only basic size metrics such as average and median length could be useful indicators for the bioassessment of river flow alterations. Finally, size-based metrics can provide an alternative approach to characterize community fish structures by reducing the costs of fish surveys in management plans.

Keywords: biological assessment; body size distributions; environmental flows; fish assemblage; stream barrier impacts

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