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Can hydraulic measures of river conditions improve our ability to predict ecological responses to changing flows? Flow velocity and spawning of an iconic native Australian fish

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Ecological responses are key indicators of river water quality. Ecological responses to changing riverine flows are often evaluated by describing the relationship between river discharge and response. However, aquatic organisms experience the hydraulics (i.e. velocity, shear stress, depth) of a river, not its discharge. Hydraulic characterizations of riverine habitats may improve our ability to predict ecological responses. We used two-dimensional hydraulic models to translate river discharge into reach-averaged velocity. Combining these flow data with water temperature and 8 years of field observations of fish spawning, we developed a Bayesian hierarchical model to predict the spawning of golden perch (*Macquaria ambigua*) in the lower Goulburn River, south-east Australia. The model suggested that probability of spawning was positively related to both discharge and reach-averaged velocity. The model also identified the critical water temperature above which both discharge and velocity start to affect spawning. Antecedent flows prior to spawning had a weak positive effect on spawning. Against expectations, there was little difference in predictive uncertainty for the effect of flows when reach-averaged velocity was used as the main predictor rather than discharge. The lower Goulburn River has a relatively simple channel and so discharge and velocity are monotonically related over most flows. We expect that in a more geomorphically complex environment, improvement in predictive ability would be substantial. This research only explores one example of a hydraulic parameter being used as a predictor of ecological response; many others are possible. The extra effort and expense involved in hydraulic characterization of river flows (e.g., velocity) is only justified if our understanding of flow-ecology relationships is substantially improved. Further research to understand which environmental responses might be best understood through different hydraulic parameters, and how to better characterize hydraulic characteristics relevant to riverine biota, would help inform decisions regarding investment in hydraulic models.