Modelling Instream Flow Effects on Juvenile Salmonid Capacity in Small Streams: Do Habitat Suitability Curves Systematically Underestimate Optimal Flows?

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Abstract

The Instream Flow Incremental Methodology (in conjunction with Habitat Suitability curves) remains one of the most widely used methods for assessing the consequences of reduced instream flows for fish. Despite its widespread use, IFIM predictions are rarely validated against direct measures of fish abundance or production, and recent studies suggest that IFIM may underestimate the consequences of low flows for production of juvenile salmonids. I compared instream flow predictions using IFIM to predictions of optimal energy flux to fish using a drift-foraging model applied to a small coastal stream using standard habitat suitability curves for juvenile coho. The use of a drift-foraging model is based on the inference that production of juvenile drift-feeding salmonids depends not only on the availability of habitat, but also on the flux of energy to available habitat, and that the available energy flux may better represent productive capacity. Relative to energy flux estimates from the drift-foraging model, IFIM using Habitat Suitability curves systematically underestimated the negative consequences of decreasing flow, indicating that the delivery of energy (invertebrate drift) to useable habitat declines much more quickly with decreasing flow than the availability of useable habitat as modelled with Habitat Suitability curves, supporting the potential for a systematic bias in IFIM predictions.