Tiz Mogollón September 24, 2012

SPUNKIAD for

Newbury, R., D. Bates, and K. L. Alex. 2011. Restoring Habitat Hydraulics With Constructed Riffles. Geophysical Monograph Series **194**:353-366.

Surprising?

I was surprised with the organization both across species and life stages within species of fish when plotting depth (m) and velocity (m/s). The Longnose dace fry for example is near the surface and almost at still water (probably near the shore), versus the adult Londnose dace is deeper and in faster velocity (towards the middle of the channel).

Puzzling?

I was puzzled by how the restoration process works – especially when the disturbance has been dredging the channel – of putting again all the cobble and the gravel needed to create a diverse habitat that caters to all life stages of fish and macroinvertebrates.

Useful?

I found the diagram on page 354 (Figure 2) useful because it shows the three combinations associated to Froude numbers – sub-critical, critical and super-critical, successfully conveying the relationship between depth and velocity.

New?

I did not know that hatchery raised fish and wild fish were so different in their behavior when the hatchery raised fish were released. While the wild fish knew where they should be to not get eaten by larger aquatic predators, the hatchery raised fish were oblivious.

Knew it already?

I already had learned of the different adaptation mechanisms of macroinvertebrates to live in a high velocity environment.

Interesting?

I found interesting the idea of an optimal design for stream restoration – that besides taking into account the physical and ecological parameters of the stream – consensus with the political, economic and social aspects also have to be obtained.

Do you agree or disagree with the findings?

I agree with the findings – for any restoration effort and particularly for restoring the biologic component, establishing the hydrology of a stream is one ingredient but the other is creating diversity of habitats to cater to all life stages and aquatic species.

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Reflection

Newbury et al.'s (2011) paper made me reflect on four unrelated issues: bridging the science between hydraulics and ecology, the ethics of stream management, the difficulty of finding reference streams when there are none, and the philanthropic philosophy of restoring to the optimal design option.

First, Newbury et al.'s (2011) paper started bridging the gap Rosgen (2011) left when not mentioning the biological and ecological considerations that have to be taken to restore organisms into streams. Incorporating hydraulic concepts – such as Froude and Reynolds number to describe the relation between velocity and depth, and viscosity respectively – to stream fish fitness is important to ensure their success if re-introduced. Furthermore, within a species the hydraulic requirements will also differ depending on life stage histories.

Second, towards the end of the Benthic Habitats in Critical Flow section in Newbury et al.'s (2011) paper, got me thinking of the possible dilemmas of ethics in stream management. The precise example in the paper was that boulders and cobbles we placed on what was before bedrock for the training of student fishers from the Manitoba Fly Fishers Association. Should we change the geomorphology of a stream to meet human needs? Or should we want to restore stream functions with the "initial" conditions to strive for ecological integrity and functioning?

Third, not all types of streams will have an "initial" condition or reference stream to compare the success of restoration efforts. This is the case in coal mining areas where there has not been altered hydrologically nor geomorphically, but instead the water quality has changed substantially (high conductivity and salinity). Such is the case of the variegate darter in western Virginia that shows there is no reference stream to know what the population's growth or survival rates are. In this case, no riffle construction is needed because that has stayed the same, but instead there has been a change in the biotic composition of these streams because of the impaired waters.

Fourth, the underlying assumption in Newbury et al.'s (2011) paper on the optimal design option is to be able to balance ecological and human needs when doing a restoration project. The main assumption is that people value the biological side of streams equally to the service this provides humans (water for irrigation or for drinking). However, is this true? Why are people motivated to provide habitat for a diversity of organisms?

If, however, some stream habitat restoration is carried out, how does the optimal design option take into account uncertainty? The resilience of an ecosystem will depend on how much is preserved, and this is directly related to how much managers decide to weigh the optimal design option. The more illustrative example is using area as a measure of importance. For example, if a certain species uses 5 acres, but the under the optimal design option this is left at 3 acres, then if a storm comes through, is there room for the population to recover? Both uncertainty and resilience are important concepts that should be included or at least acknowledged.