Advances in Science and Monitoring in Headwater Drainage Features

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Vulnerability of Headwaters

Historic Data Source: McGill University
Examples of Headwater Drainage Features
Headwater Streams constitute 50 to 80% of the length of rivers (Schlosser 1982)

90% of a river’s flow may be derived from catchment headwaters (Saunders et al. 2002)

The spatial extent of headwaters can account for 70-80% of the total catchment area within a watershed (Gomi et al. 2002)

Headwater basins act as “hydrologically active areas” becoming activated during wet conditions and are linked hydrogeomorphic components of the basin (Gomi et al. 2002)
Wipfli (2005)
• Examined organic drift from fishless headwater streams in forested mountainous terrain in Alaska
• Streams were permanently flowing but had minimal flow at certain times of the year
• Found that small streams contributed enough organic materials to support 100-2000 YOY salmonids
• Is this comparable to S. Ontario?

Photo source: Wipfli (2005)
• Replicate study from Alaska by Wipfli (2005) in S. Ontario
• Partnered with University of Waterloo – Odum Idika and Dr. David Barton
• Examined forested and agricultural HDFs
• Examined 16 HDFs, 13 ephemeral and 3 intermittent sites throughout the GTA
• Sampling occurred after rain events – a wet year!
Overall Findings…

- HDFs seem to be important sources of food for fish
  - Indirect Fish Habitat
- Cumulatively important
- How much material reaches downstream?

### Comparison of Drift between Wipfli and Idika Studies

<table>
<thead>
<tr>
<th></th>
<th>Plant material mass (g)</th>
<th>Invertebrate mass (mg)</th>
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</thead>
<tbody>
<tr>
<td>Wipfli (2005)</td>
<td>10.4</td>
<td>163</td>
</tr>
<tr>
<td>Idika (2010)</td>
<td>32</td>
<td>650</td>
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</tbody>
</table>

Toronto and Region Conservation  for The Living City
Influence of HDFs on Downstream Fish Productivity
HDFs as Seasonal Fish Habitat

Total Number of Fish Captured

- Adults
- Juveniles
- Total

Site Code

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Spatial and Temporal Variability

Spring

Summer
Monitoring Protocol

• New OSAP module was needed to:
  – Understand cumulative watershed functions
  – Permit classification per HDF guideline

• Characterize flow, feature, and sediment – OSAP S4.M10

• Rapid assessment
  – E.g. Flow conditions: enter codes for no flow, standing water, or interstitial, minimal, substantial
Headwater drainage features:
• are highly variable with regard to flow and contributions
• appear to provide both indirect and direct (seasonal) fish habitat
• need to monitor in order to better understand functions
• likely cannot be replicated by SWM ponds or storm sewers
• Need to protect functions
• Solutions?: Maintaining open channels and LID
Headwater Study

Ecologists are concerned that anthropogenic changes, such as urbanization, in headwater areas can cause degradation in downstream aquatic systems. However, the process of this degradation and how it relates to the natural functions of headwater drainage features is poorly understood and likely underestimated. TRCA, in collaboration with many partners across Southern Ontario, has undertaken a series of studies to better understand these natural functions and begin to address some of the gaps in the science.

The final version of the headwater guideline received TRCA Authority Board approval on July 26, 2013. Subsequent to approval of this version by TRCA’s board, some changes were made to provide further clarification based on additional comments that were received from industry partners. The final version of the document can be found below.

Evaluation, Classification and Management of Headwater Drainage Features Guidelines - Approved July 2013 with resolution January 2014

Major changes to the document since the 2009 version, include:
1. Overhaul of the evaluation section to include connections to the new headwater sampling protocol, which is now a new module in the Ontario Stream Assessment Protocol (OSAP).
2. Better direction on assigning hydrology classes.
3. The evaluation section has also been modified to allow sampling to be scoped based on important criteria, such as feature sensitivity, flow and form, and proposed alteration. A scoping table has been included to provide further direction on appropriate scoping.
4. The classification system now takes the data that were collected through the evaluation and classifies features according to hydrology, riparian condition, and if negative alterations are proposed, fish and fish habitat, and terrestrial habitat. All factors are...
Acknowledgements

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Ausable Bayfield Conservation Authority
Upper Thames Region Conservation Authority
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Great Lakes Sustainability Fund
Toronto Remedial Action Plan
Southern Ontario Stream Monitoring and Research Team
Many dedicated field crews and volunteers