Geomorphic controls on physical habitat variability in a hydropeaking system

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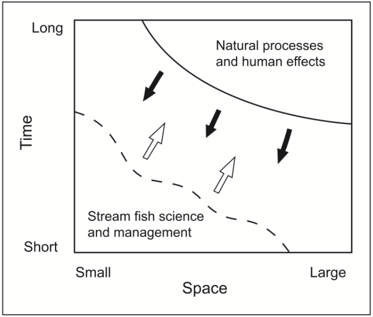
Introduction: Linking geomorphology and habitat

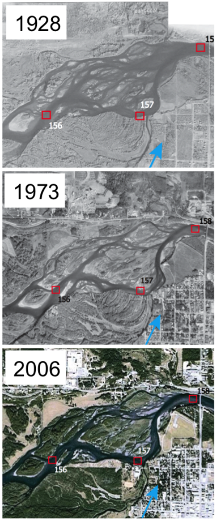
- Geomorphology affects fish habitat at many scales
- Environmental changes and flow regulation create a changing physical template
- We need tools with predictive capacity to link morphodynamics with habitat change at different scales
    - Indicator methods to guide future choices



Fausch et al. (2002)

Example: Neckaho River, BC

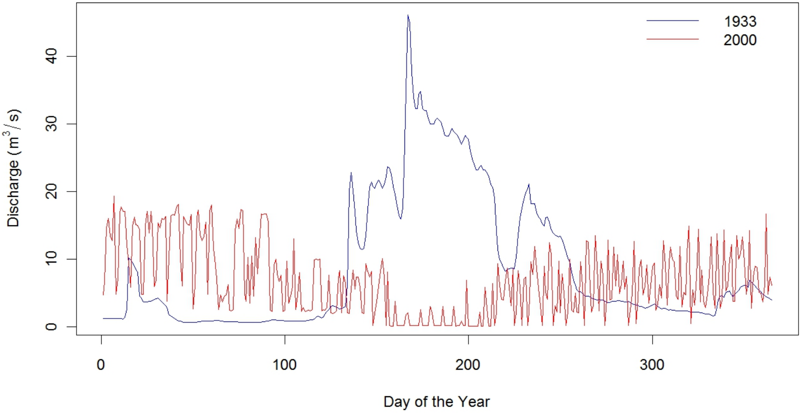
- Impoundment and major flow changes since 1952
- Endangered white sturgeon population
- Recruitment failure since 1967 coincides with sediment composition changes and geomorphic shifts reducing spawning habitat



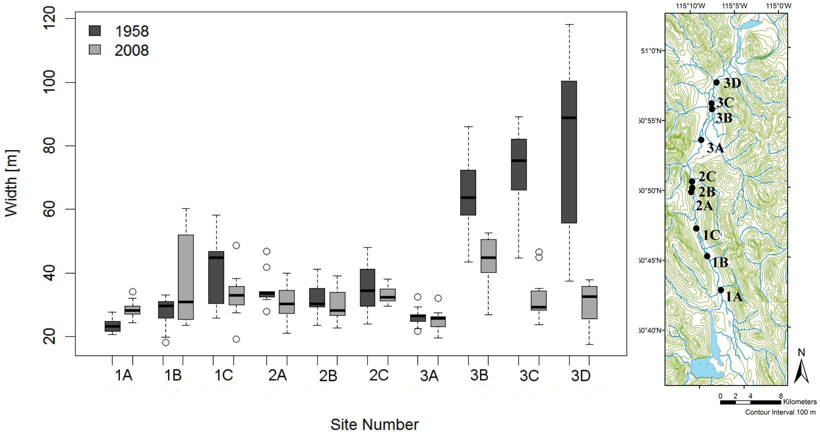
Kananaskis River, AB

- Gravel-bed river in the Canadian Cordillera
- Pocaterra Dam constructed in 1955
- Hydropeaking operation (1-20 m^3/s daily)
- Shift from bull trout and cutthroat trout to mountain whitefish and brown trout

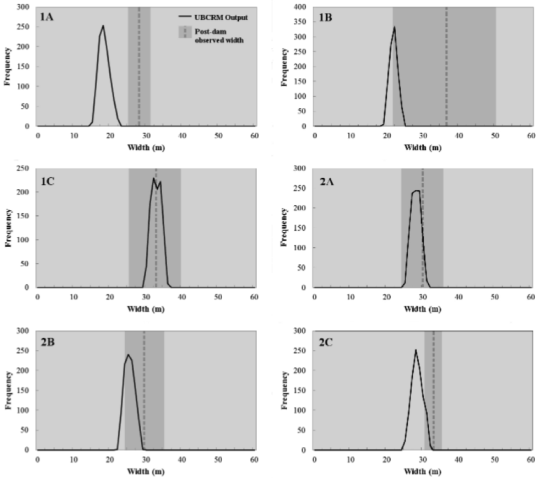
Flow changes

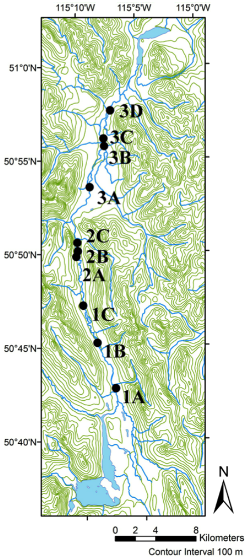


Channel width changes

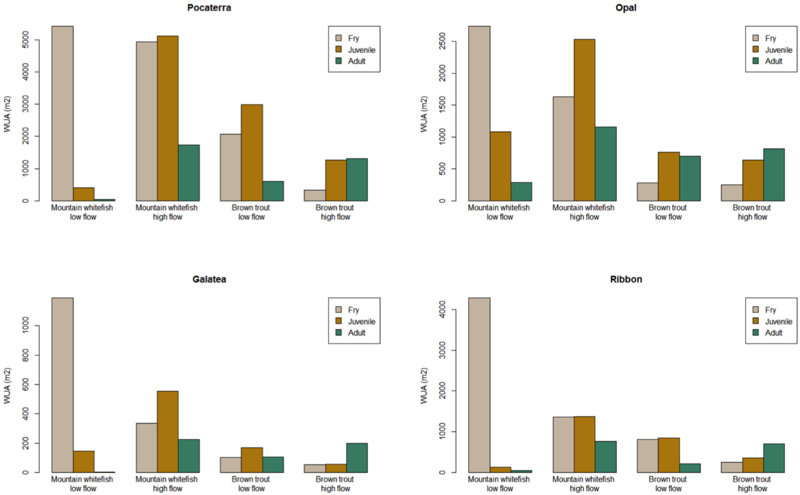


UBC Regime Model application





Effects of peaking on in-stream habitat



Current understanding: geomorphic changes and habitat

Summary:

- Channel planform and morphologic units have changed since dam construction
- Physically based UBC Regime Model can predict reach-scale channel characteristics
- In-stream habitat (weighted usable area) changes with daily flow fluctuations but this relationship depends on morphology and fish life stage/species

Future directions

How do we link reach-scale morphodynamics with physical habitat changes?

Environmental change
- Sediment supply, discharge, sediment size
- Dam effects

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UBC Regime Model
- Predicted reach-average conditions (depth, Froude number, width, etc.)

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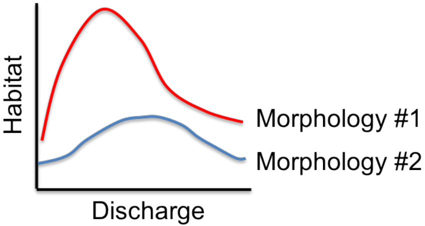
Habitat modeling
- Statistical methods and hydrodynamic modeling



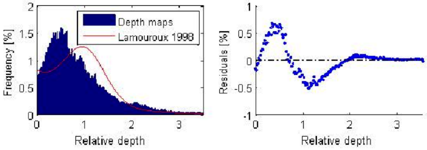
Potential tools: UBC Regime Model

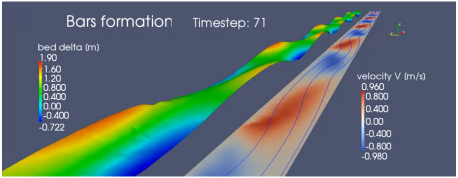
Shown to predict reach-scale conditions due to changes in formative flow better at some sites than others

- Ice effects?
- Geomorphic sensitivity to hydropeaking?
- Riparian vegetation?
- Non-regime conditions?

Potential tools: Linking reach-scale controls to habitat

- Statistical habitat models (Lamouroux et al. 1998, Schweizer et al. 2007)
- 2D coupled numerical morphodynamic models (e.g. GIAMT2D)
- Geomorphic theory to link bedform characteristics and side channels with mesohabitat





Conclusion

- Regulation of the Kananaskis River has long-term geomorphic effects and limits in-stream habitat at the reach scale
- Existing data and previous work provide an ideal background for this case study
- Future work will focus on linking changes in geomorphic governing conditions with habitat responses