Ecohydraulics
A Brief History and Some Contemporary Examples

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The worst thing that can happen is not energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government. As terrible as these catastrophes would be for us, they can be repaired within a few generations. The one process ongoing . . . . that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly that our descendents are least likely to forgive us.

E.O. Wilson, 1985
IAHR is the oldest international association engaged in water engineering and research - founded in 1935 by the world’s leading hydraulic research institutes.

Beijing
China Institute for Water Resources and Hydropower Research (IWHR)

Madrid
CEDEX and Spain Water
(public-private partnership, including the Spanish Ministry of Agriculture and Suez Environnement)

www.iahr.org
Image courtesy of Dr. Wolfgang Kamke, Karlsruhe Institute of Technology
We need to consider "novel ecosystems" that function almost completely differently than the ecosystems in which they evolved.

Resilient or sustainable ecosystems are not necessarily desirable ecosystems

Peter B. Moyle, 2014
Habitat Metrics to Assess the Behavior of
White Sturgeon in a Regulated River

Hells Canyon of the Snake River

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Sturgeon

- 25+ species of this ancient fish.
- Appeared over 175 million years ago.
- Long lived & late maturing
- Multiple years between spawning.
- Difficult to assess long term (life cycle) implications of short term alterations to their environment.
Monitoring...

- Tracking of individual juvenile sturgeon over 3 weeks, each week representing:
  - load following
  - steady high flow
  - steady low flow
Habitat Results

Spatial and temporal habitat information throughout the study area.

Juvenile White Sturgeon

Suitable Habitat (SI>0)
Optimal Habitat (SI>0.64)
Findings from Habitat Analysis

- Habitat modeling using traditional SI parameters (U and h) did quantify an amount of available habitat.
- Habitat modeling
  - did not show a large influence of discharge on habitat quantity,
  - is not directly transferable to bioenergetics.
- Telemetry data indicate a difference in areas used under different flow regimes (steady vs. load following).
Required Energy (Respiration)
Deadwood bathymetry
Reservoir: the Big Squeeze
Annual Bull Trout Movement
Summary

Contemporary Challenges for River Managers

- Clear (and simple) system-wide goals:
  - ‘novel’ ecosystems
- Linking local restoration actions to system outcomes
- Our rivers are dynamic and must be managed accordingly
- Composite suitability index and maximum usable habitat is a useful guide but of limited use in understanding system dynamics