Fitting tools to our understanding of the problem – Habitat Suitability Indices and PHABSIM

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Purpose of models

• **Expedite decision-making** in most accurate way feasible given limitations of time and budget

• Efficiency

• Accuracy

• Transparency

• Credibility}

In eyes of affected public

(taxpayers, landowners, resource advocates, resource professionals)
Model should address issue

- One tool doesn’t fit all questions
- Tool’s value in one application doesn’t assure its utility in another
- Evaluate model and components critically
- Remember Hutchinson’s n-dimensional niche
- Habitat can also be viewed as $\geq n$-dimensional
Hutchinson’s n-dimensional niche

PHABSIM and HSI (HSC)

- PHABSIM is used for water management and evaluating how it affects fish habitat.
- PHABSIM uses HSI to assess habitat value of hydraulic dimensions distributed at different discharges (flows, Q).
- HSIs for PHABSIM generally address DEPTH, current VELOCITY, and SUBSTRATE or COVER (microhabitat scale).
PHABSIM and HSI (HSC)

• Use of PHABSIM results requires subsequent integration with
  – Time
  – Hydrology
  – Life History
  – Other relevant scales (meso- and macrohabitat)
  – Temperature and other aspects of Water Quality
Develop HSI for PHABSIM

• For each of the dimensions for which HSI are being developed, what intervals of the dimensions are being used more (preferred) and which are avoided?

• Measure availability randomly (grid)
• Measure use (snorkel for juveniles, may be able to see spawning adults by walking or wading)
• Relate Use/Availability on scale of 0 to 1.0
Evaluate HSI

• At **independent location** from HSI development, set another grid for availability of each dimension

• Determine fish distribution on grid

• Are fish distributed as expected based on HSI?
Transferability of HSI

- Stream size (Tronsen Cr vs Chelan R)
- Absolute depth vs relative depth (proportional) – work by Steve Boessow (WDFW) on spawning cutthroat trout
- Association with other dimension
- Physiological limitations (DO, temperature, swimming speed)
Evaluating PHABSIM model

• In addition to HSI, a major aspect of PHABSIM is the hydraulic model. It predicts distributions of DEPTHS and VELOCITIES at locations in a stream channel at different flows.

• This part of PHABSIM is evaluated during calibration of each hydraulic model.

• Depending on model options, comparisons are available at several flows. Results are generally favorable.
Evaluating PHABSIM model

• Questions remain about validity in big rivers (e.g., Spokane R) where 3-dimensional hydraulics and HSI may be desirable

• Plunge pools produce complex 3-dimensional hydraulics
Evaluating PHABSIM model

• Does model outcome match empirical information? Model should approximate reality!

• If not, what can be done to model to make it match empirical information?
  – Change HSI?
  – Address different dimension?
  – Change model computation?
Evaluating PHABSIM model

Evaluating & revising PHABSIM models

Evaluating & revising PHABSIM models

- With further biological information incorporated, better agreement with empirical data → improved model
Model should address issue

• Although PHABSIM has merit for water management, do not assume it works for other issues
• Find a model that addresses what aspect(s)/dimension(s) of the environment will change and how that change affects the species of concern
• Other models may use HSI, but they should address the niche/habitat dimensions that are subject to change, not necessarily D & V
Species are not alone

- Will the change being considered affect other co-occurring species?

- If so, how will the change to the co-occurring species affect the target species?
Natural hydrology

• Native fish thrive in natural watersheds with natural flows. How close can we get (especially considering climate change)?

• What do we change to get closer?