

# Modeling the Effects of Condit Dam Removal on Tule Fall Chinook Salmon Spawning Habitat

James R. Hatten<sup>a</sup>, Thomas R. Batt<sup>a</sup>, Gary J. Barton<sup>b</sup>, Joseph J. Skalicky<sup>c</sup>,  
and Rod Engle<sup>c</sup>

<sup>a</sup>U.S. Geological Survey, Western Fisheries Research Center, Columbia  
River Research Laboratory, Cook, WA.

<sup>b</sup>U.S. Geological Survey, Idaho Water Science Center, Boise, ID.

<sup>c</sup>U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office,  
Vancouver, WA



# Project Goal

- Evaluate the effects of Condit Dam removal on tule fall Chinook salmon spawning habitat

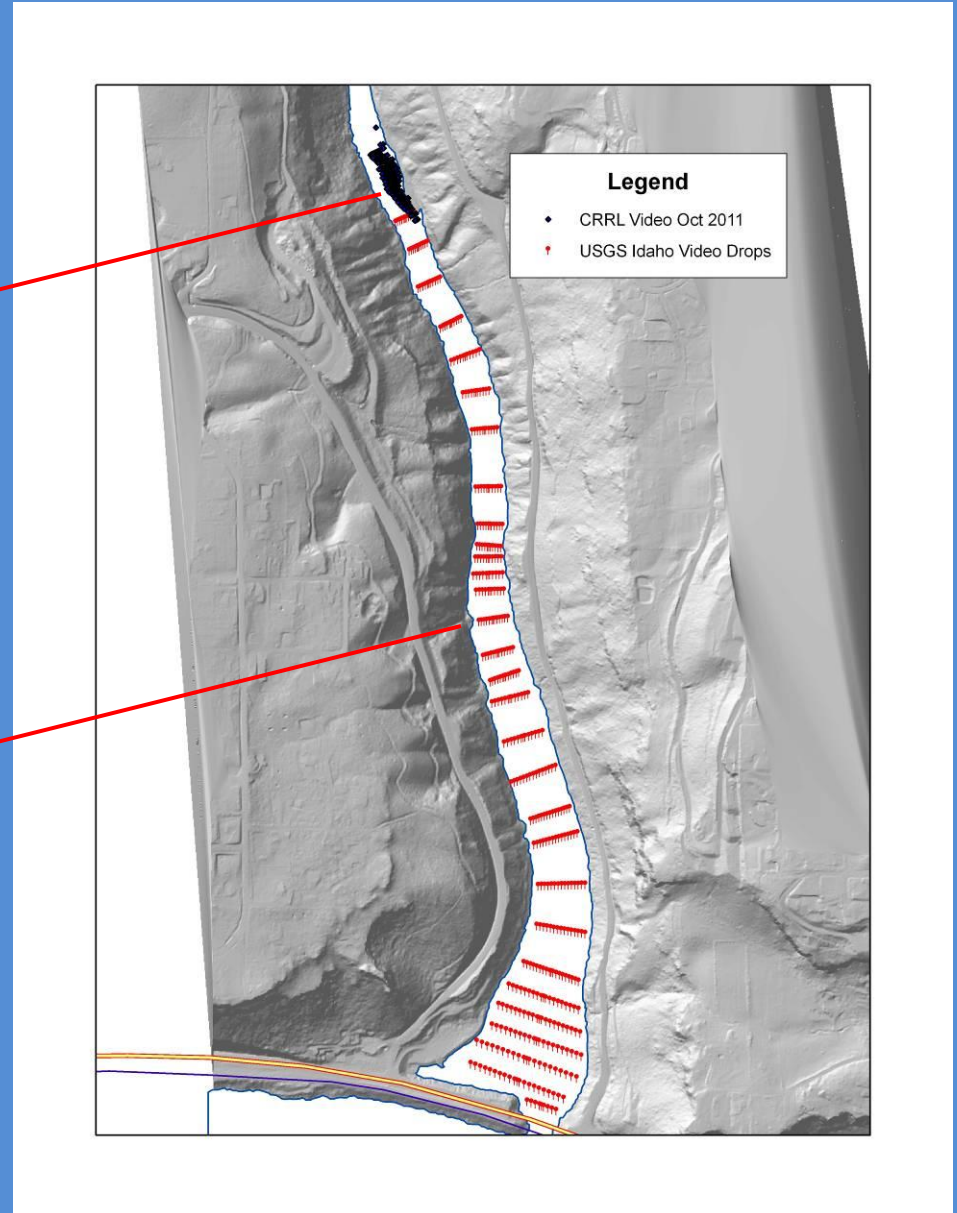
## Project Objectives

### Characterize spawning habitat of tule fall Chinook salmon spawning habitat

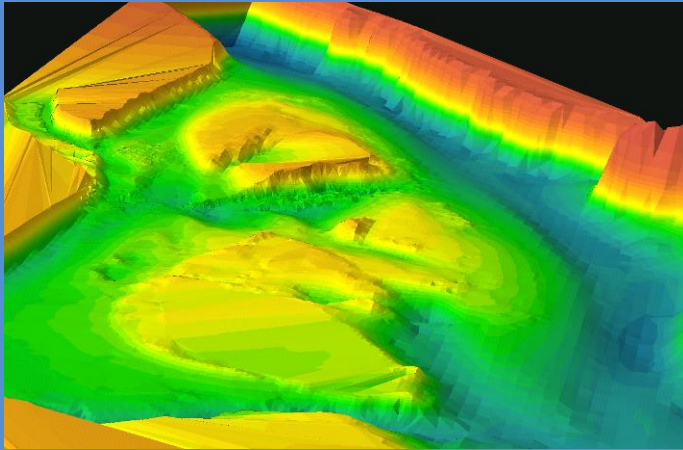
- ✓ characterize substrate composition and embeddedness
- ✓ identify hydraulics associated with spawning habitat
  - o two-dimensional (2D) hydrodynamic model
  - o depth averaged velocities (max, min, ave)
  - o water depth
  - o Froude number (flow resistance; pool, riffle, glide)
  - o create a predictive model of spawning habitat

**Repeat methods and conduct change detection following dam removal**

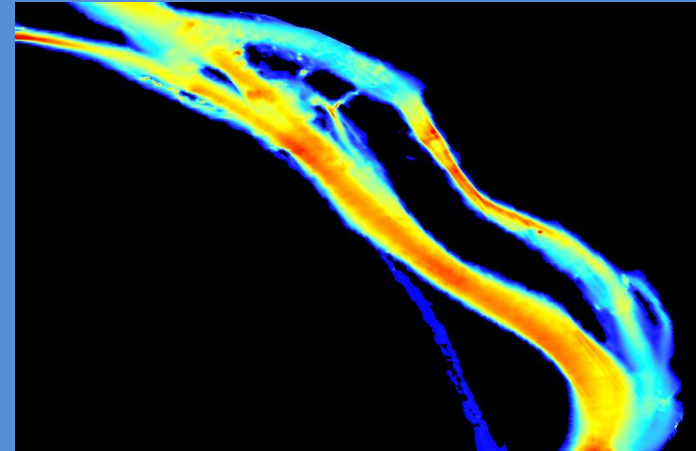
# Bathymetry and Substrate



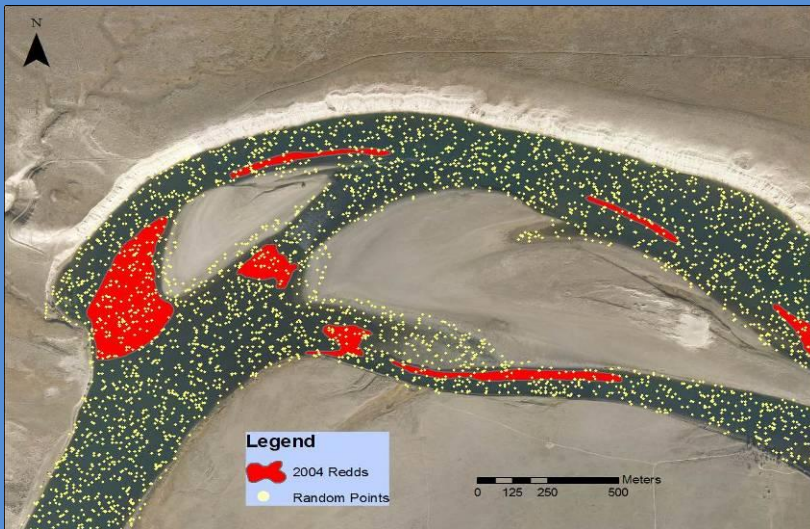
# Developing Spatially Explicit Habitat Models by Integrating GIS, River2D, and Logistic Regression



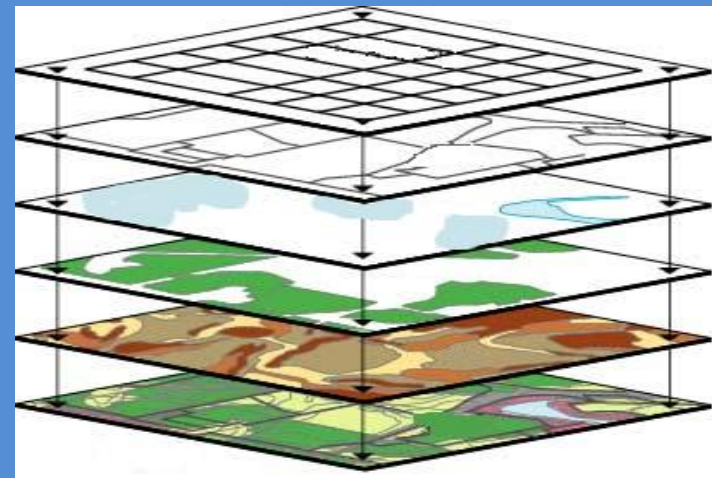
Bathymetry



Hydraulic Model Output

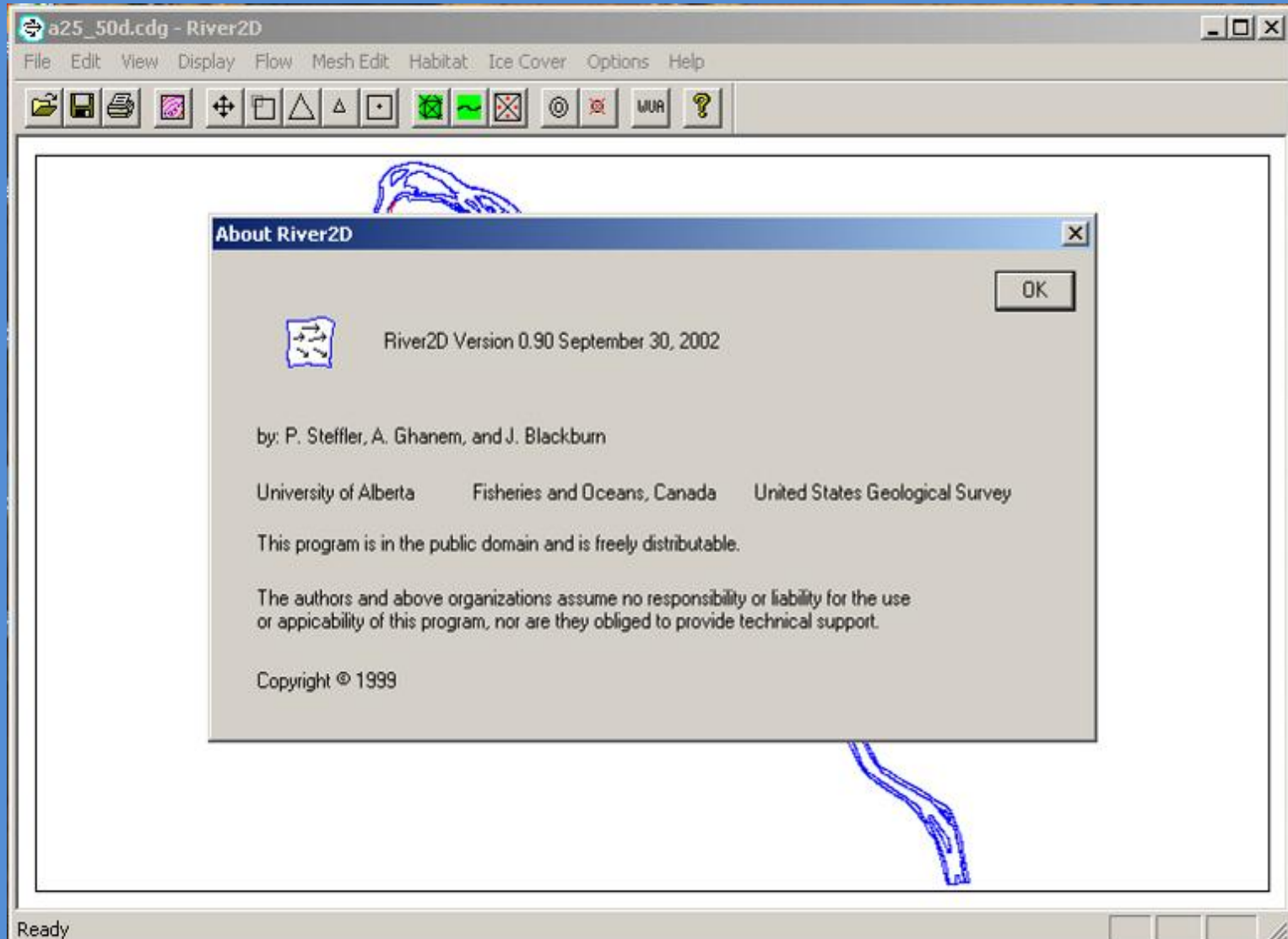


Presence/absence

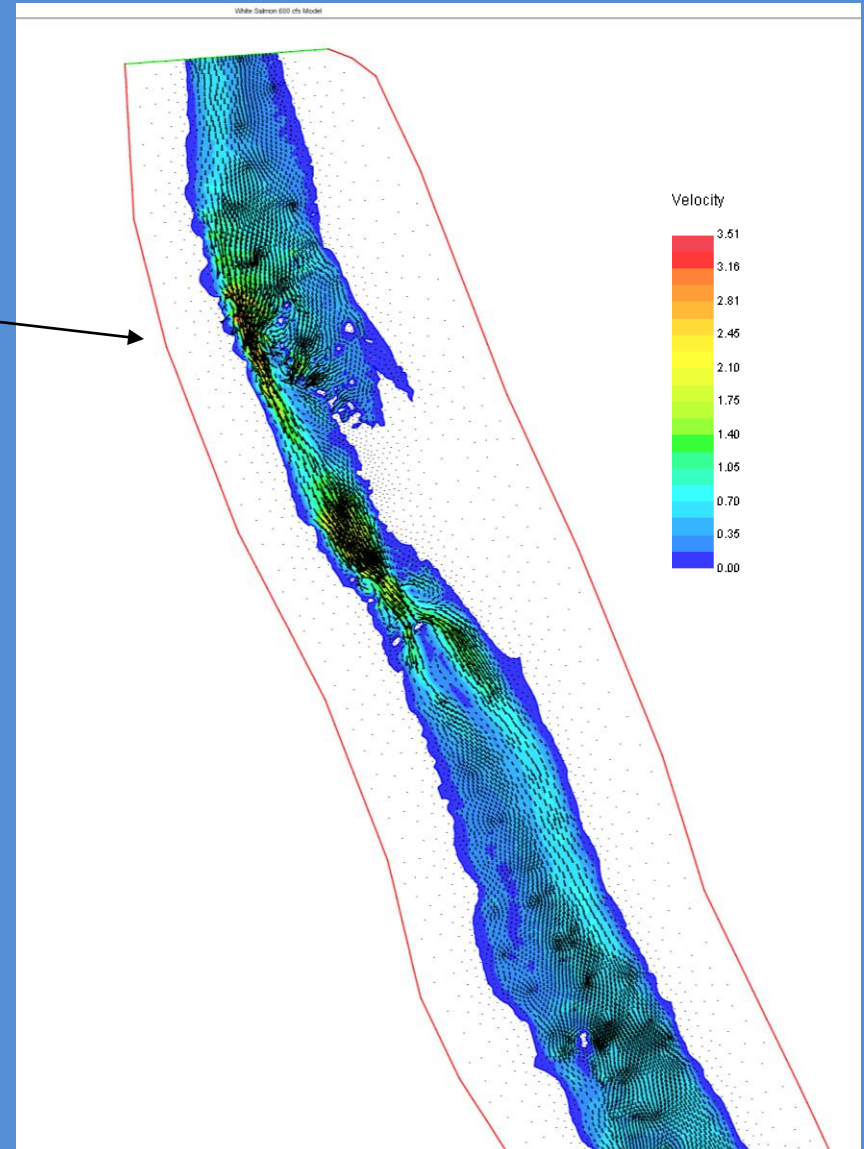
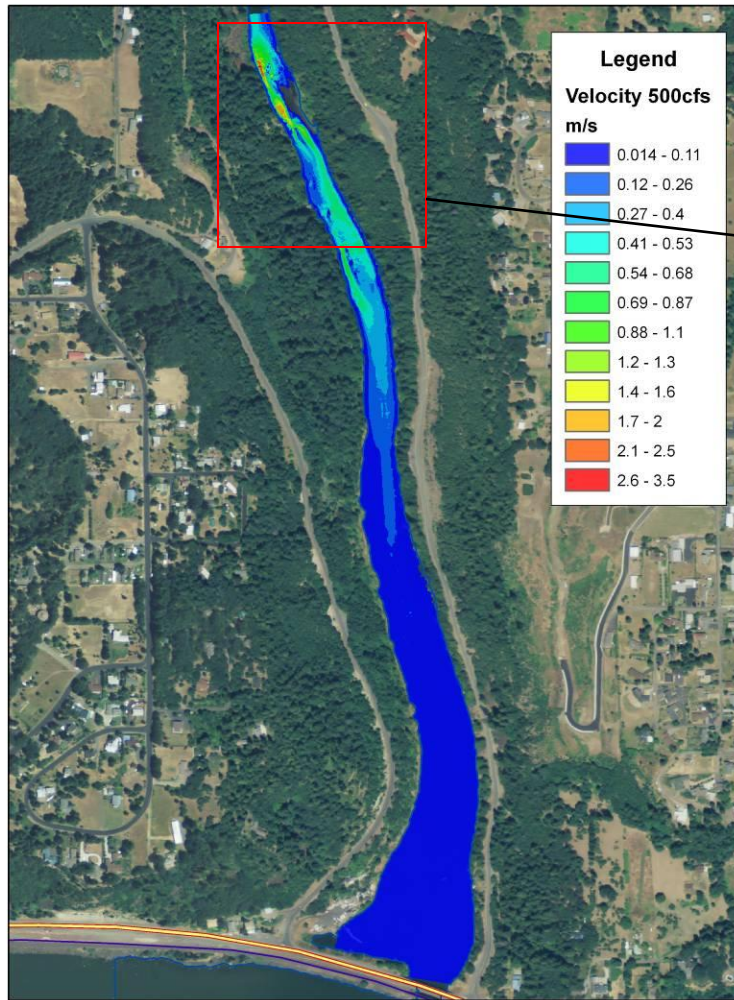


GIS: cell-based modeling

# Hydrodynamic Modeling

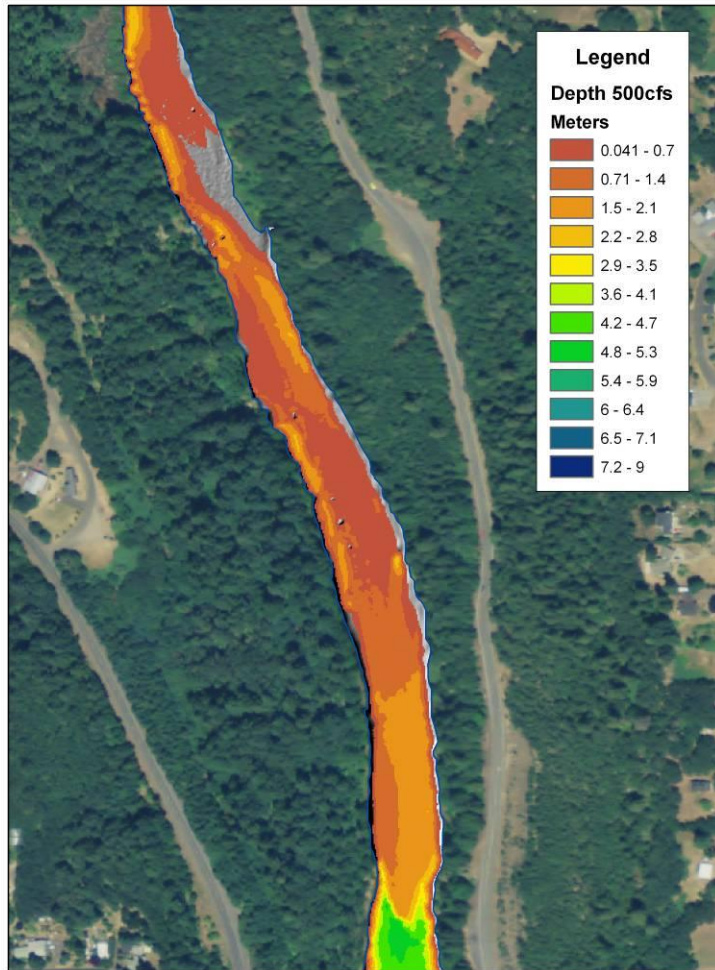


# 2D Hydrodynamic Modeling: velocities

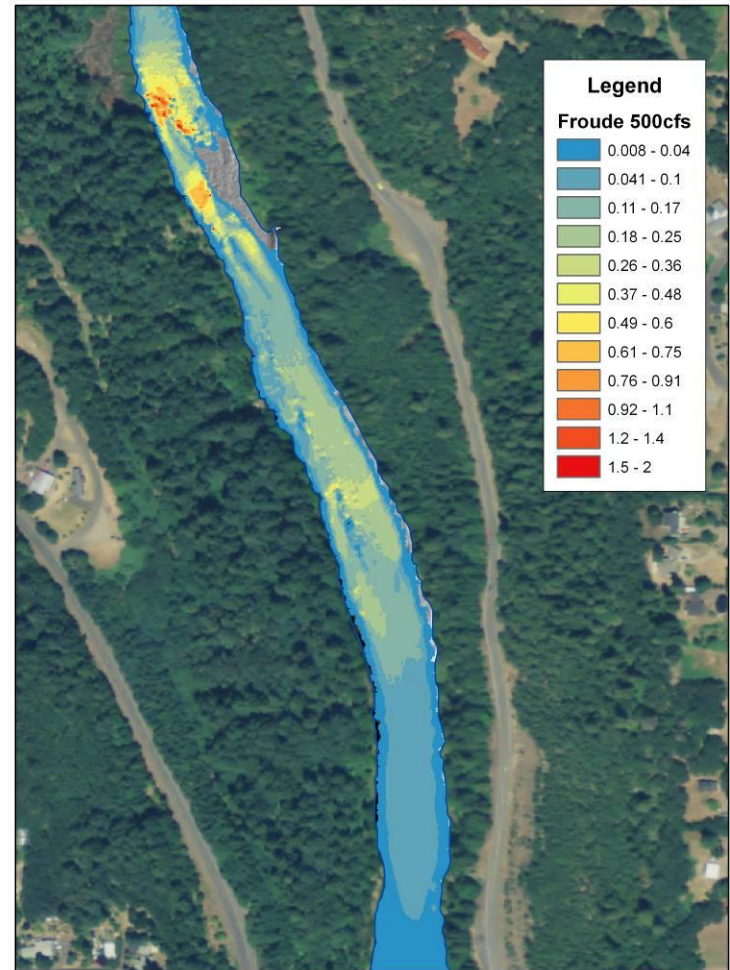


# 2D Hydrodynamic Modeling

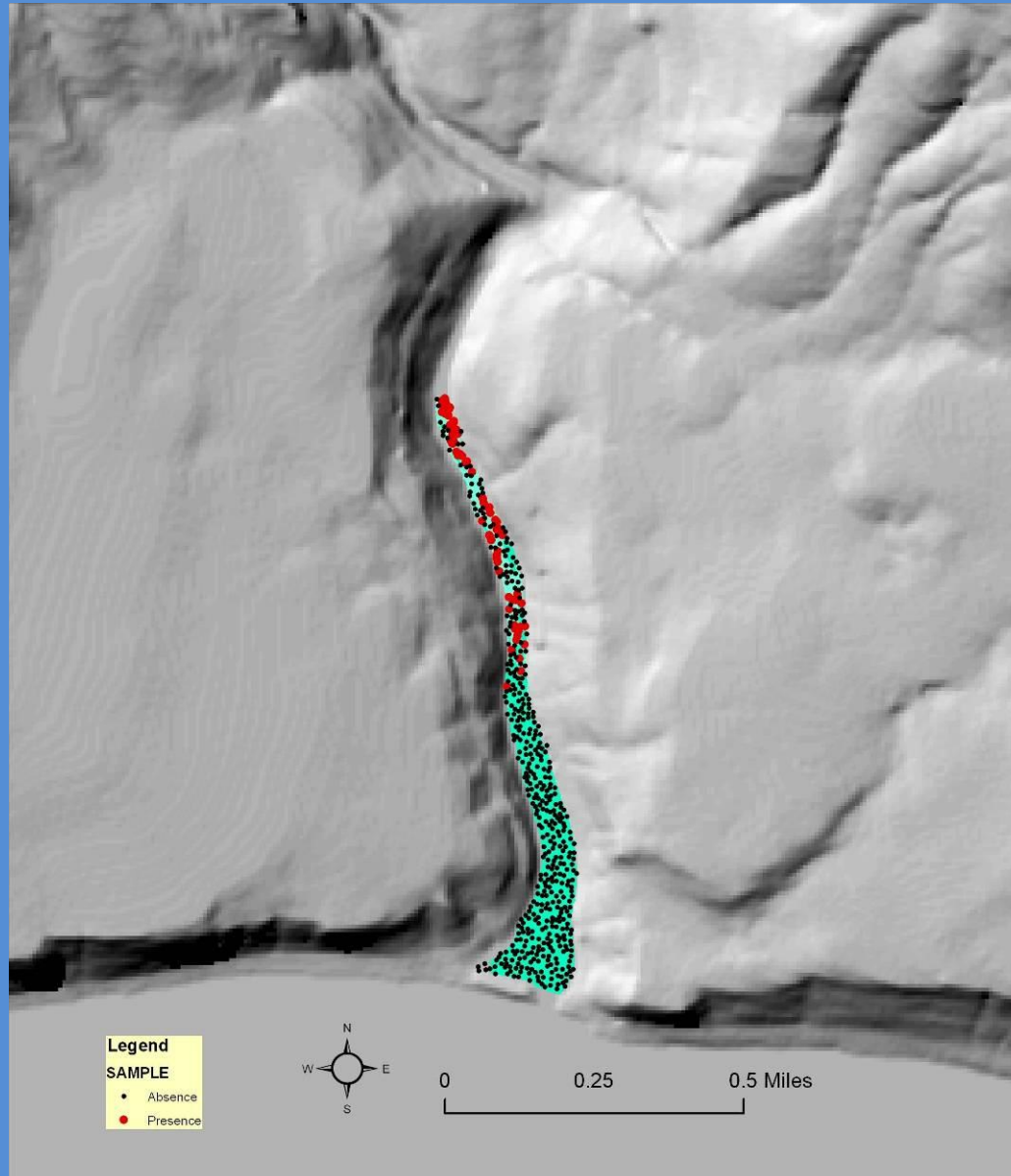
Depth



Froude

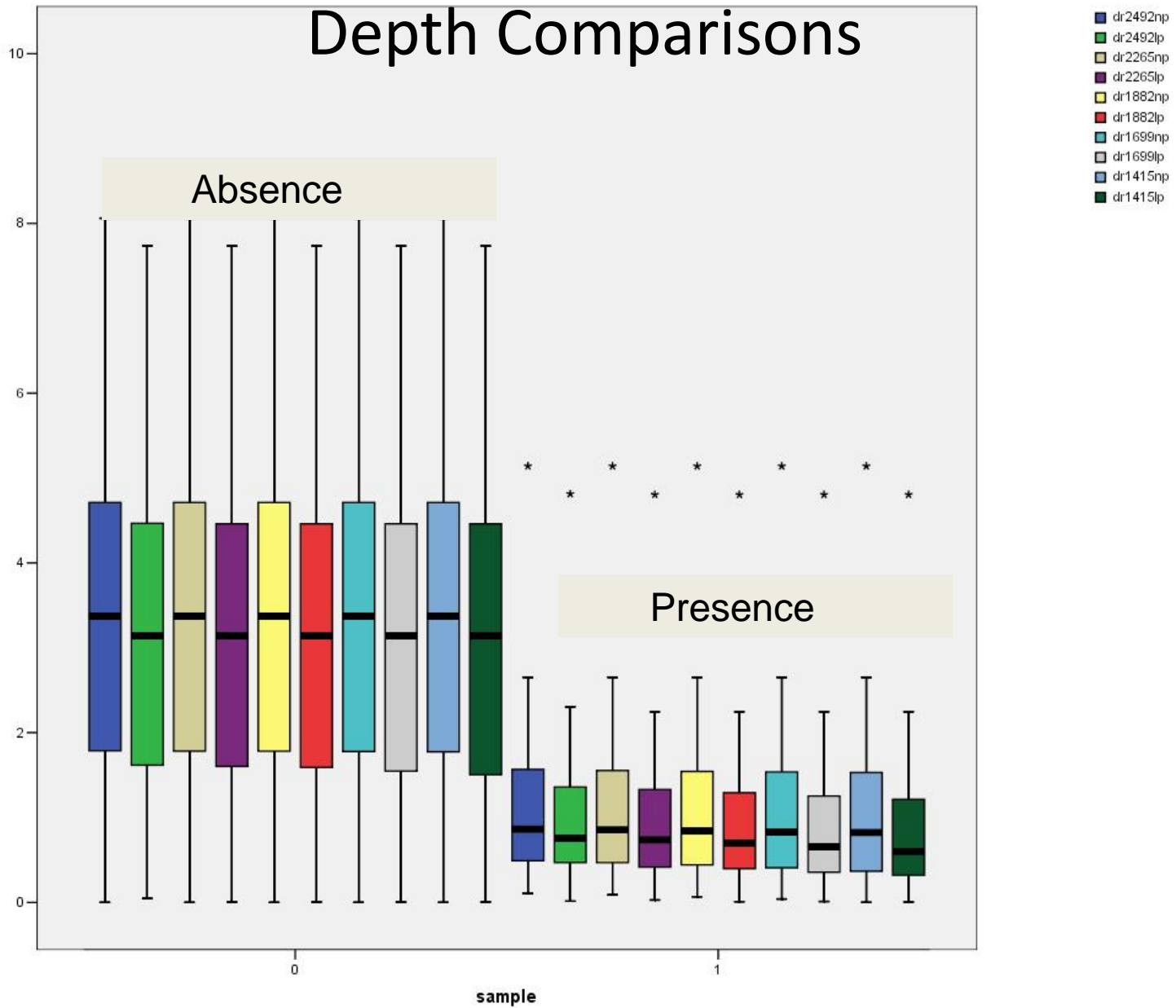


# Habitat Modeling

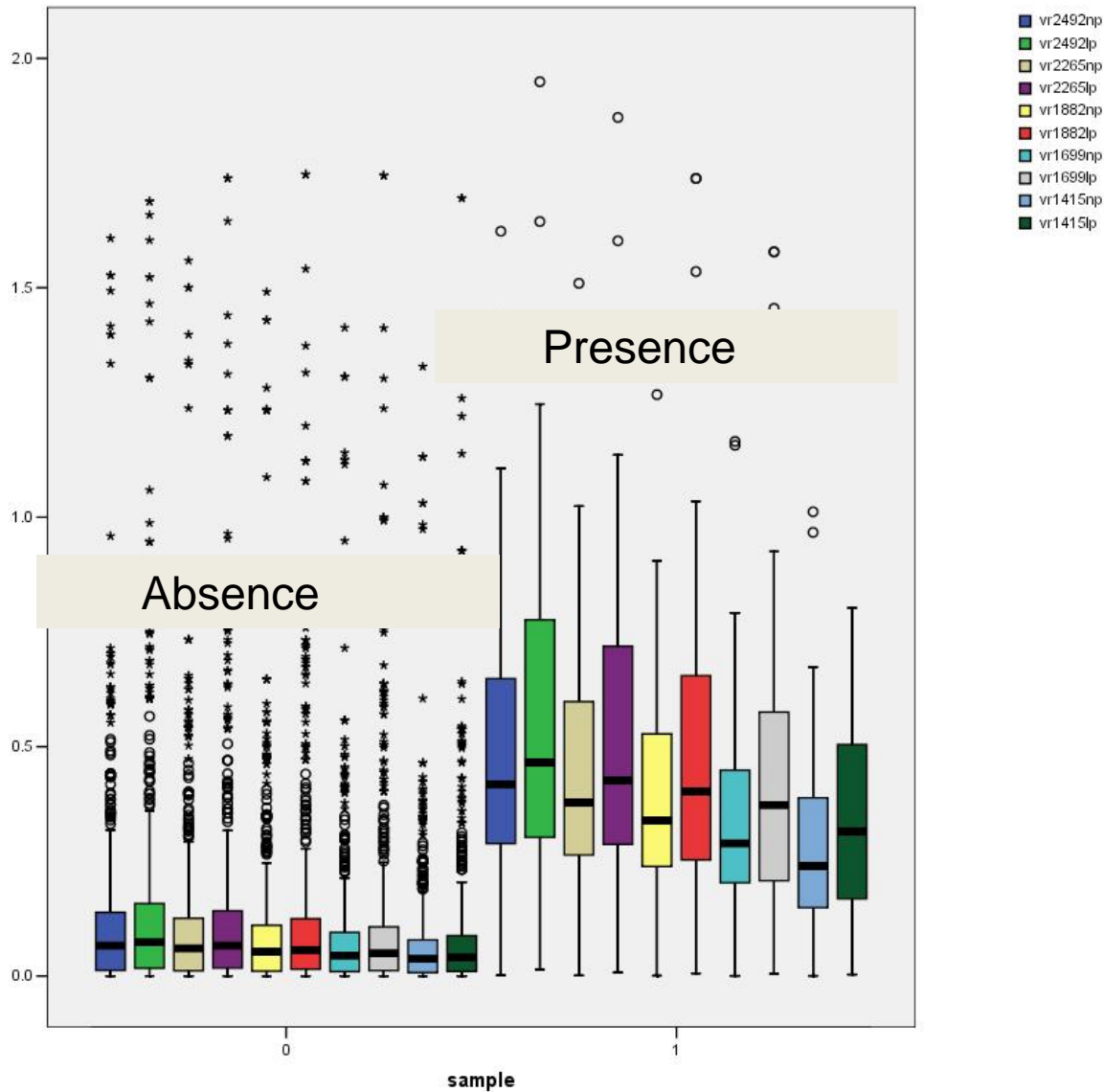




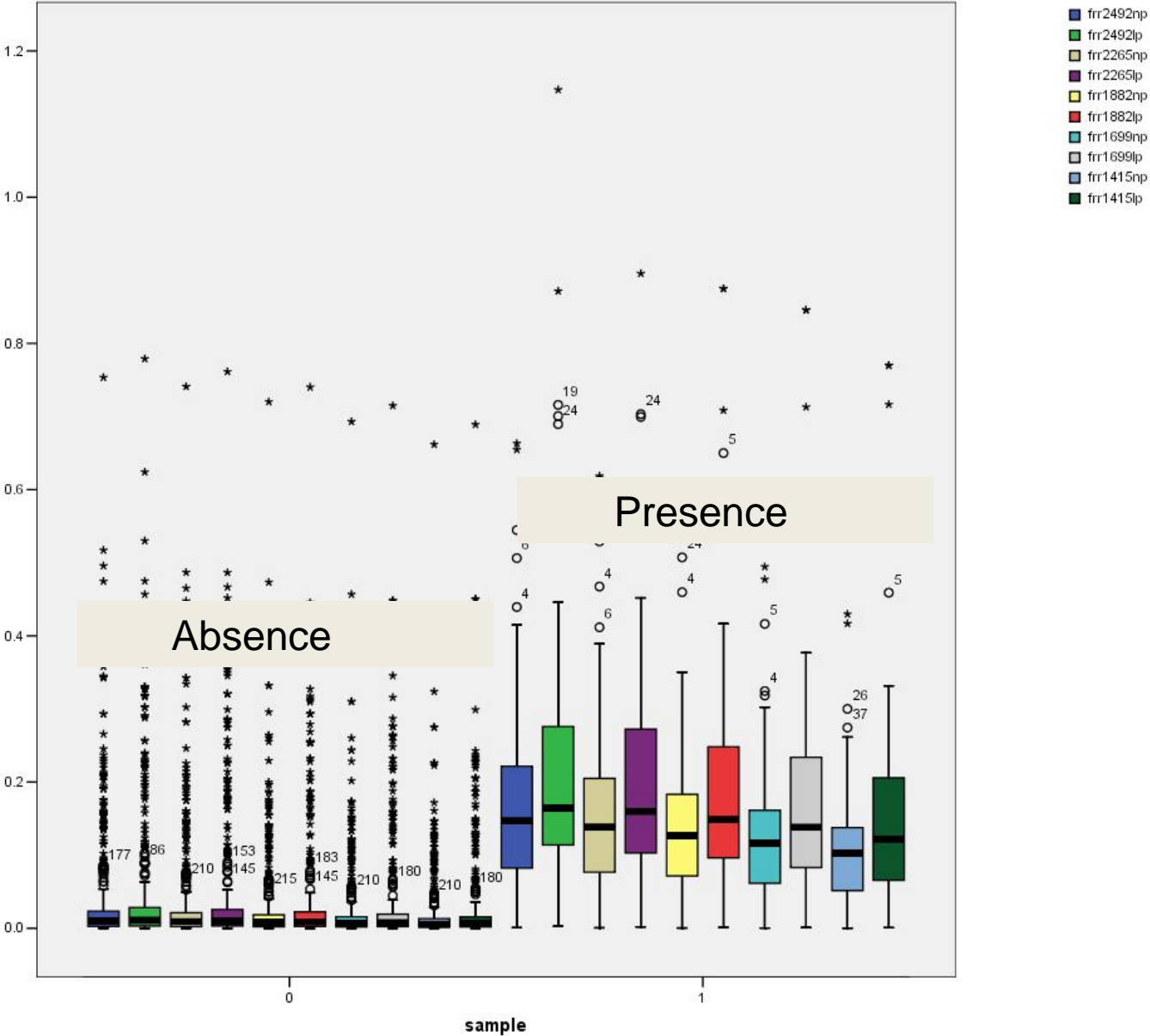
# Depth Comparisons



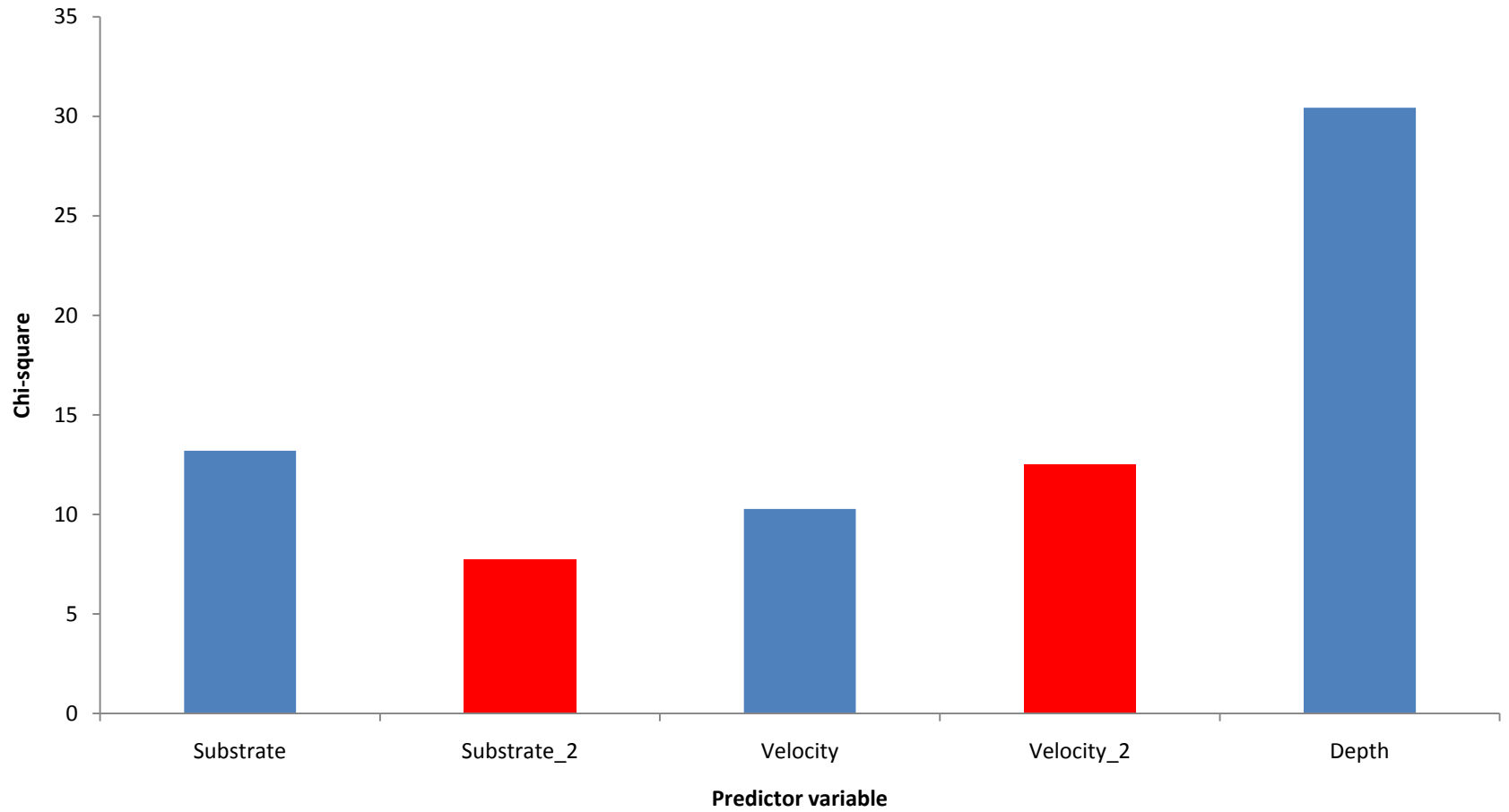
# Velocity Comparisons



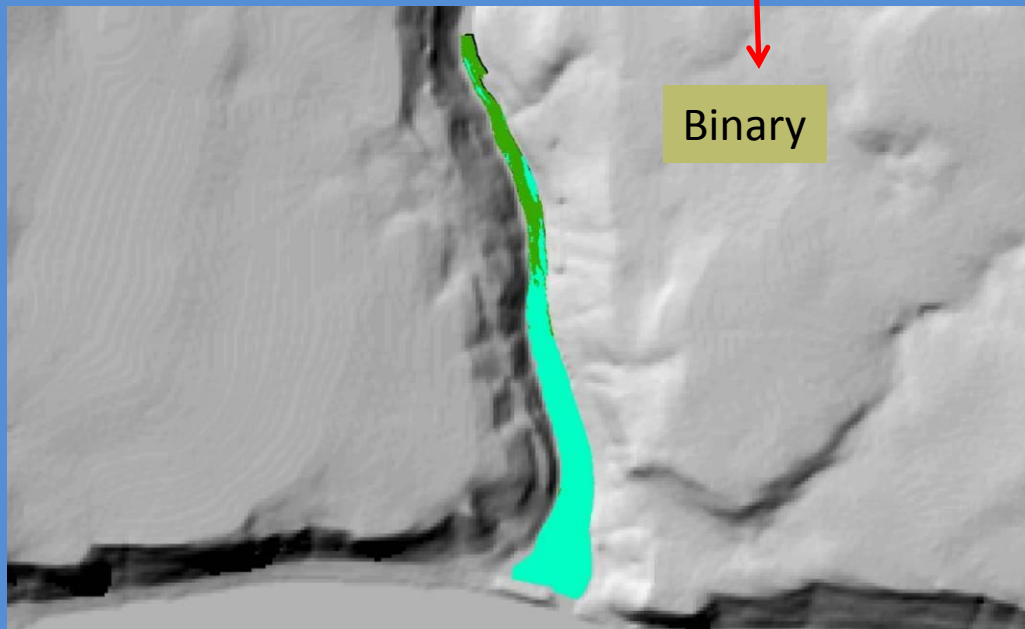
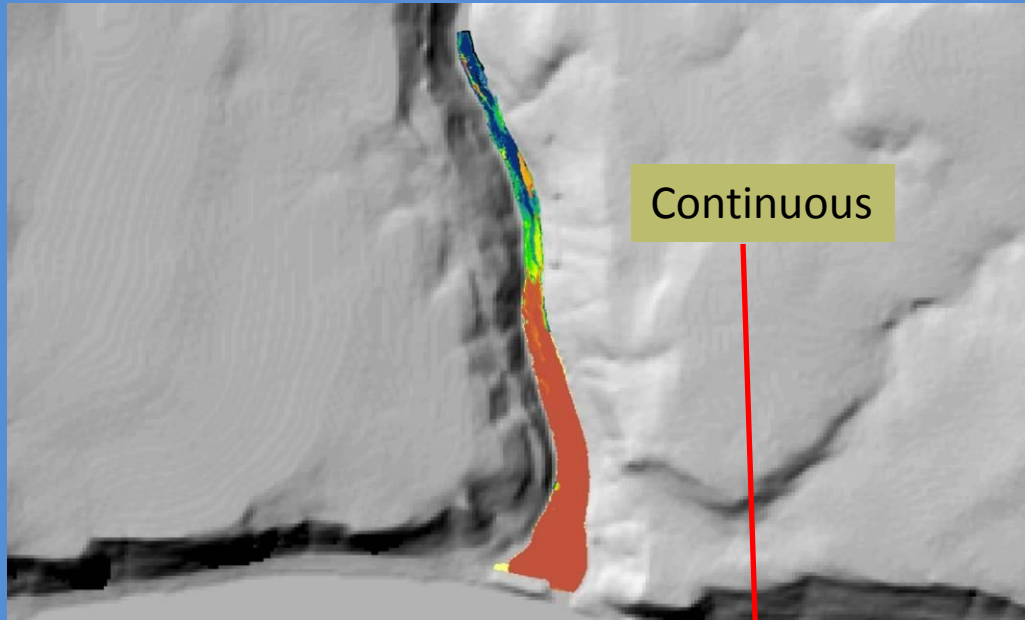
# Froude Comparisons



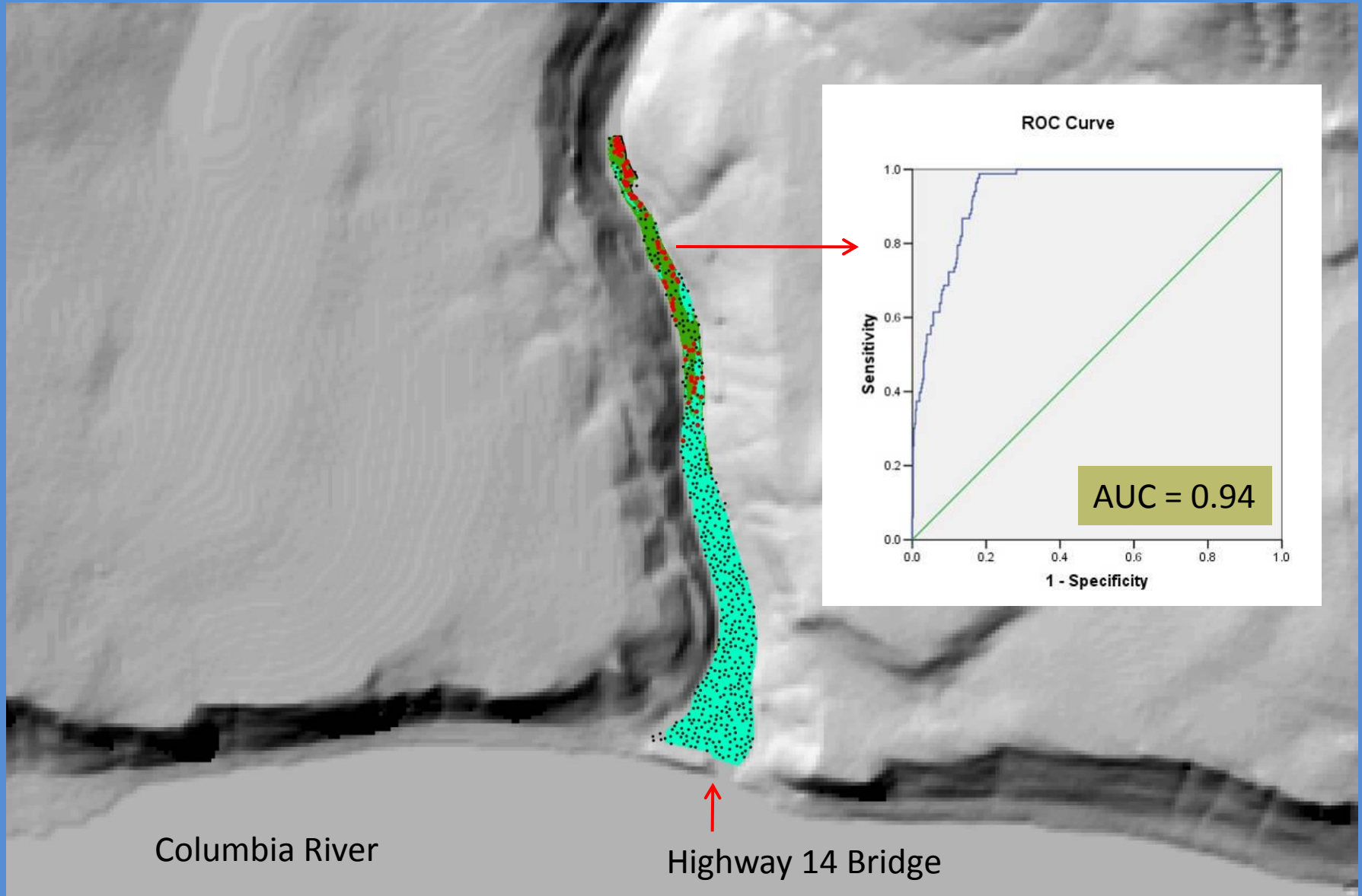
# Covariate Significance



# Spawning Habitat Suitability



# Fish-habitat Model Classification Accuracy



# White Salmon In Lieu Fishing Site

June 2011



January 2012



# Upstream from SR14

October 2011



December 2011





# White Salmon River Delta

December 2011



# Comparisons: before and after dam breach

Before



After



# Comparison: before and after

Before



After



# Comparisons: before and after dam breach

Before



After



# Conclusions

- We successfully characterized tule fall Chinook salmon spawning habitat prior to dam breach
- Tule fall Chinook salmon show distinct preferences for flow, substrate, and water depth during spawning
- Our habitat model obtained > 90% classification accuracy
- Large changes have occurred to the lower White Salmon River and they will continue to change monthly for years?
- We will repeat our methods during upcoming years and conduct change detection to quantify effects of dam breaching on tule fall Chinook salmon spawning habitat