Field Validation of Habitat Modeling of Chinook Spawning and Fry Life Stages in the lower Klamath River

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  - California Department of Fish and Game

Overview

- Characterization of Available Physical Habitat
- Hydraulic Modeling of River
- Fish Location Sampling
- Conceptual Habitat Model Development for Chinook Spawning and Fry
- Field Validation of Habitat Predictions

Characterization of Available Physical Habitat

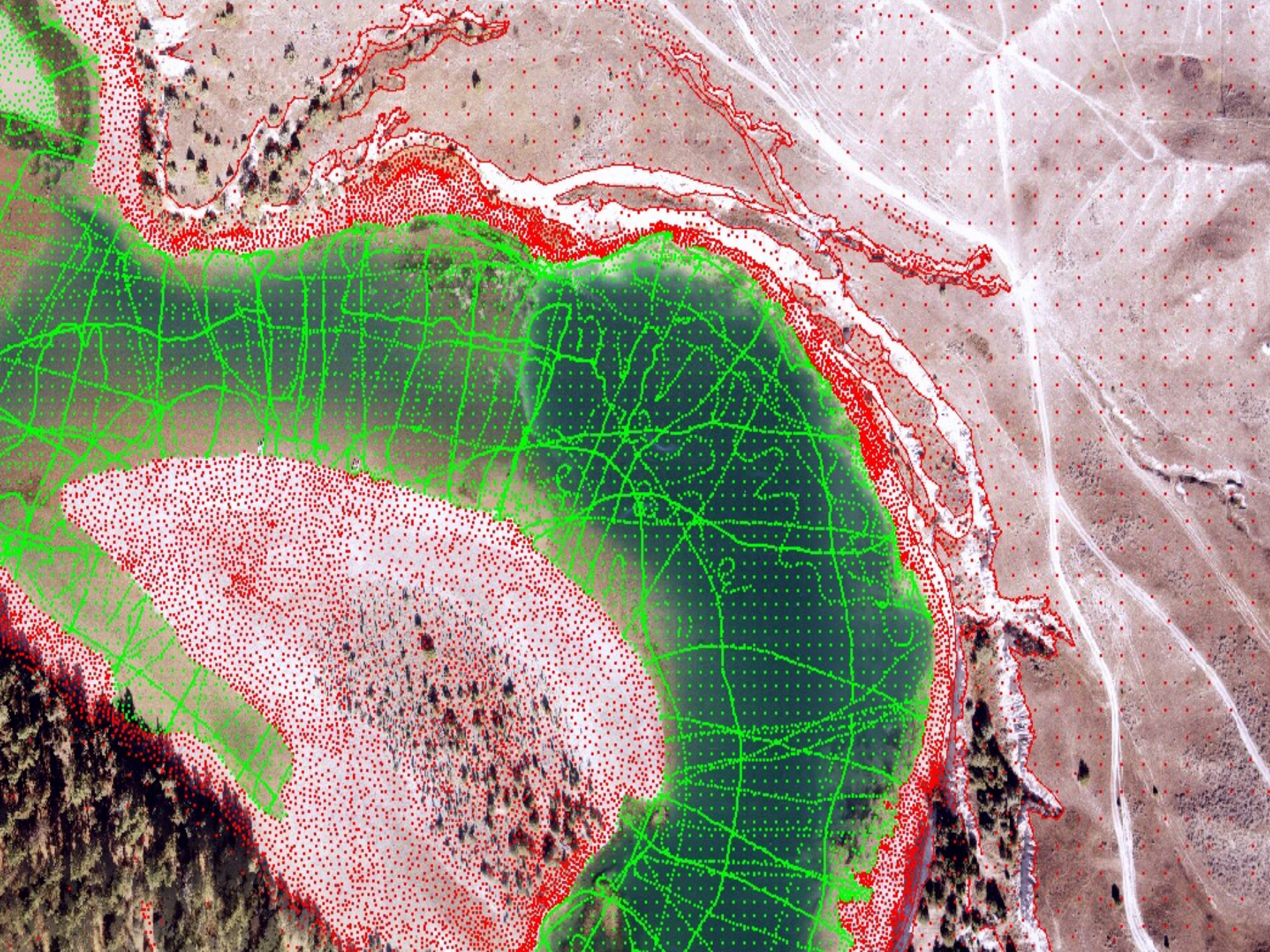
- **Data Acquisition of Channel Characteristics**
  - *Three Dimensional Channel Topographies*
  - *GIS based Integration of Physical Attributes*
- **Template for Hydrodynamic Modeling**

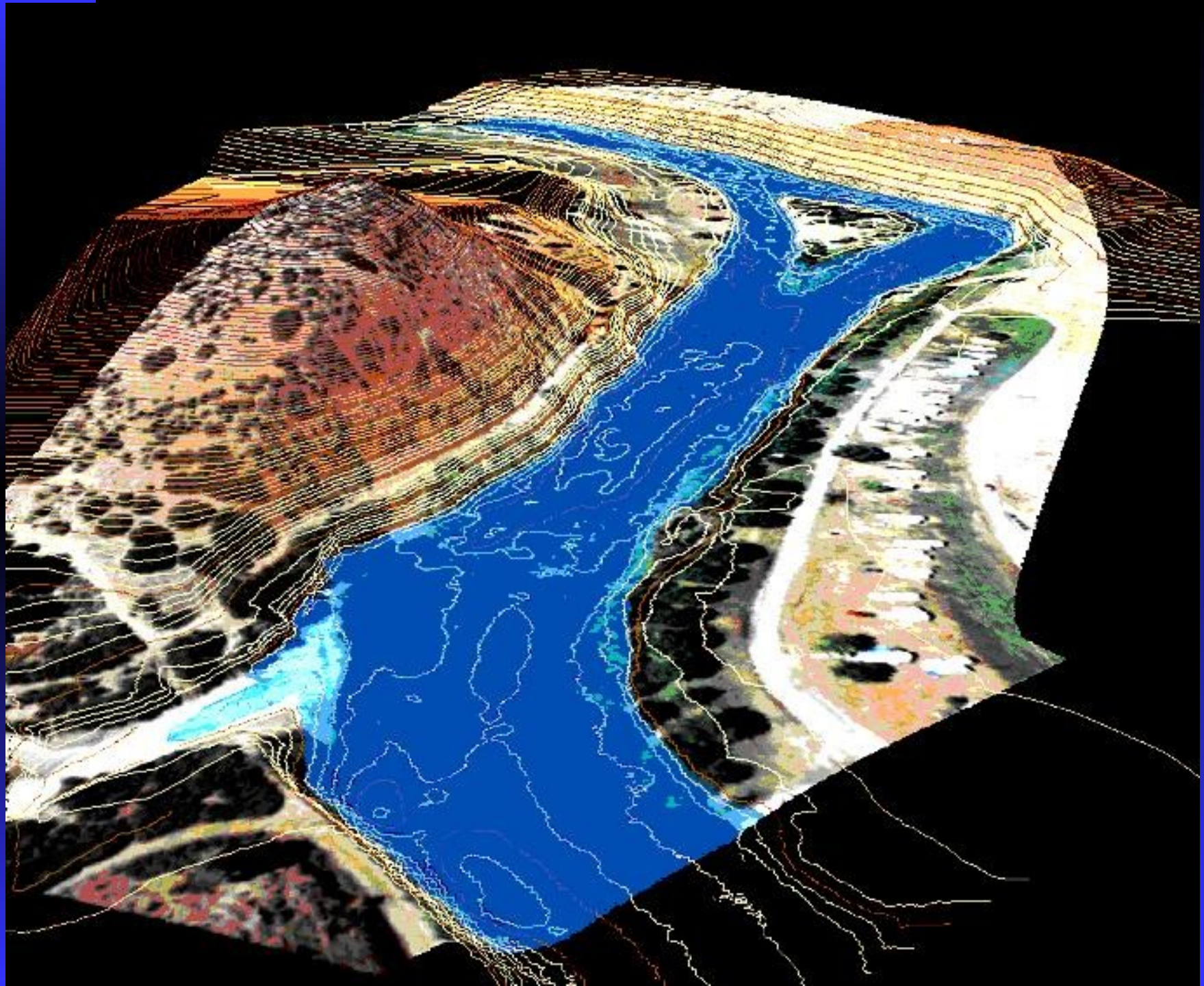
Low Elevation High Resolution Aerial Photography with Softcopy Photogrammetry



Underwater Topographies – Acoustic Mapping





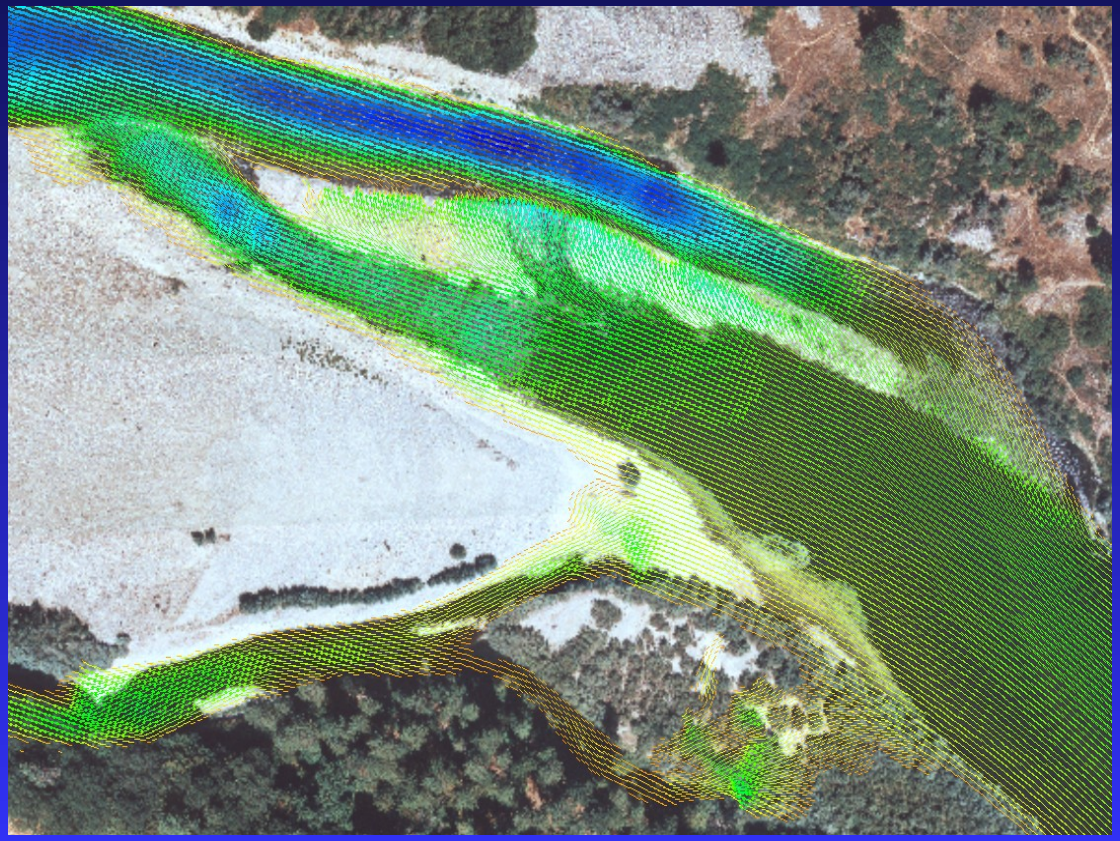


Integrated Topographies are Represented as a Computational Mesh for Hydraulic and Habitat Modeling

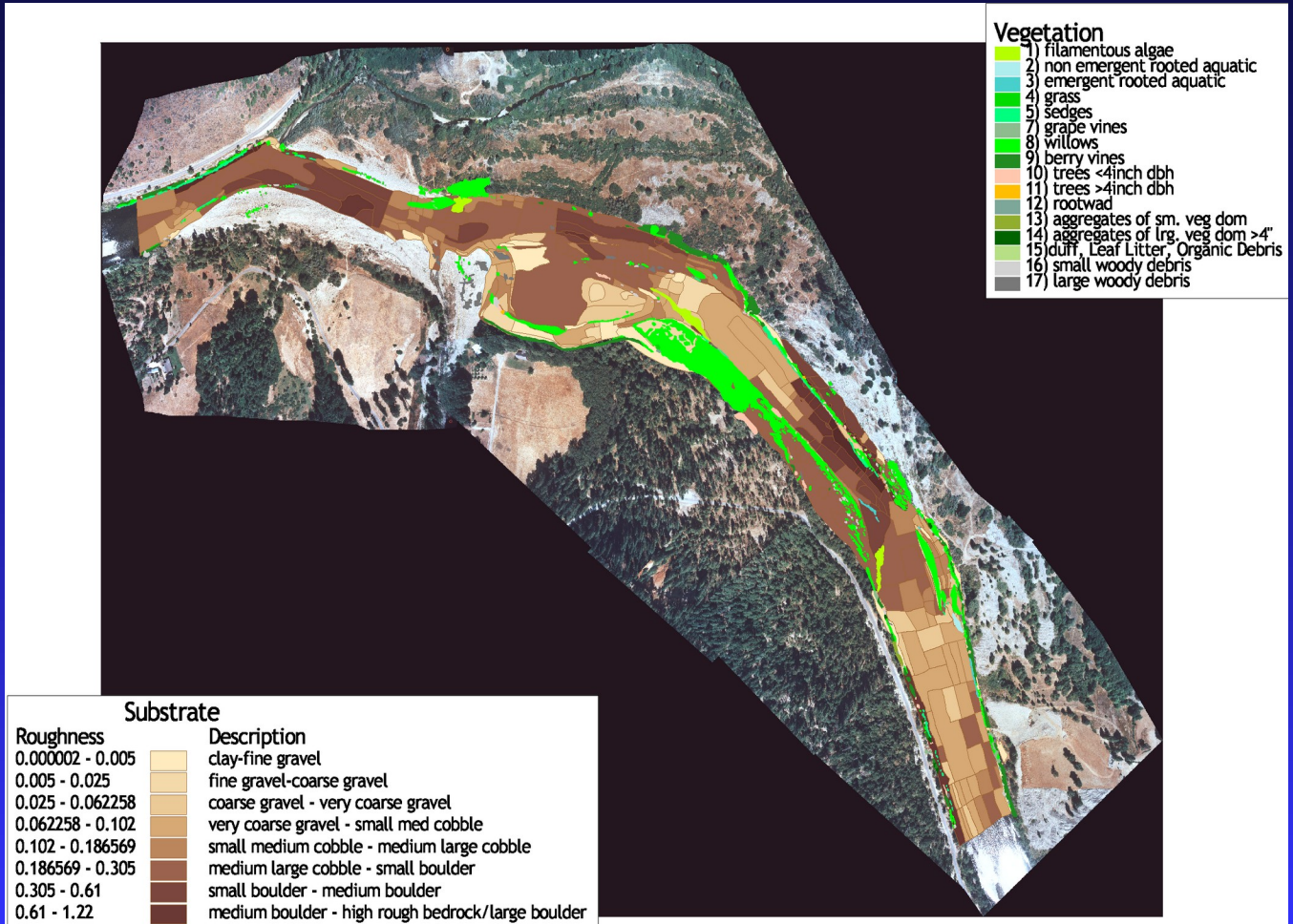


Hydrodynamic Modeling

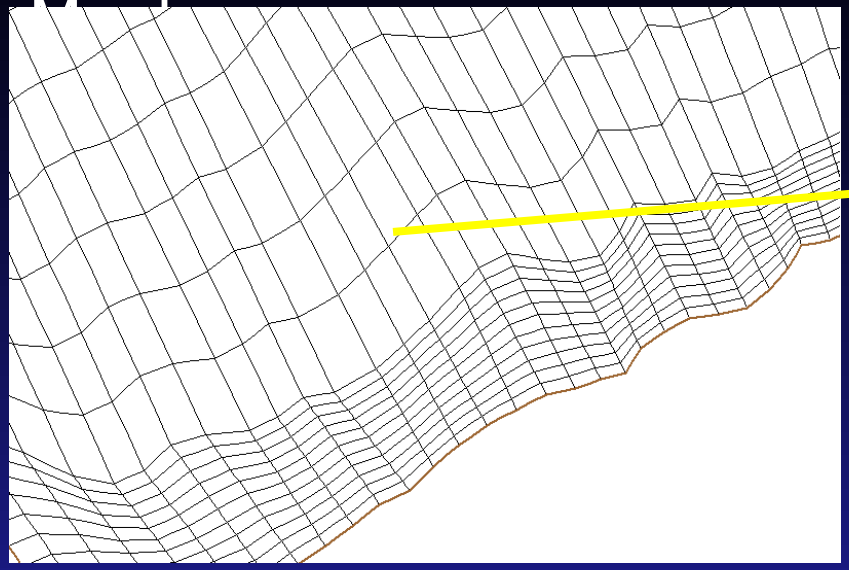
- 2-dimensional hydraulic model
- 0.5 meter spatial resolution of computational mesh



Field Mapping of Substrate and Vegetation Polygons with GIS to Assign Attributes at Each Mesh Point



Computational



Node I,J

Attributes:

- “Cell” Area
- Depth
- Velocity
- Substrate
- Distance to Cover
- Distance to Waters Edge

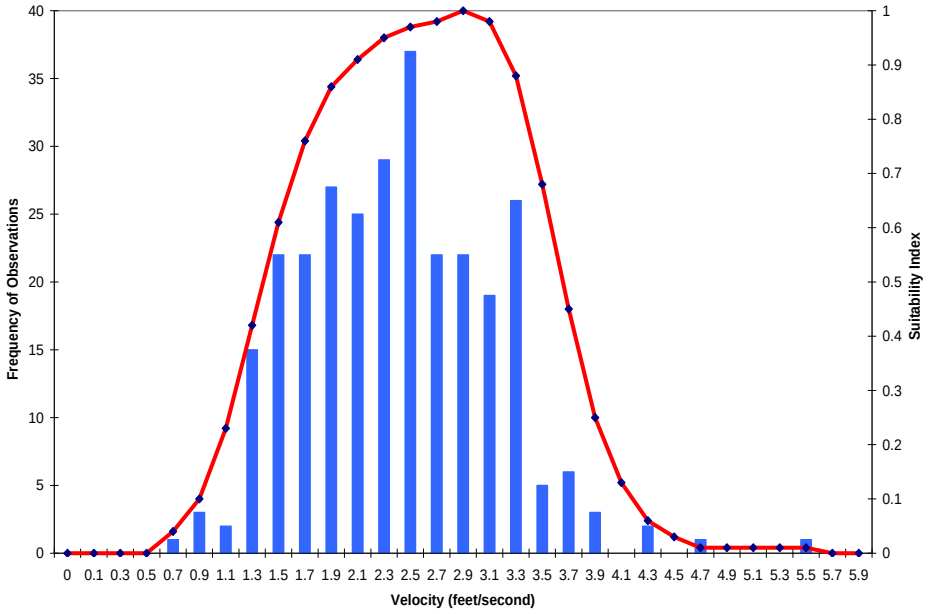
Fish Location Sampling – Surveyed to Computational Mesh Coordinate System

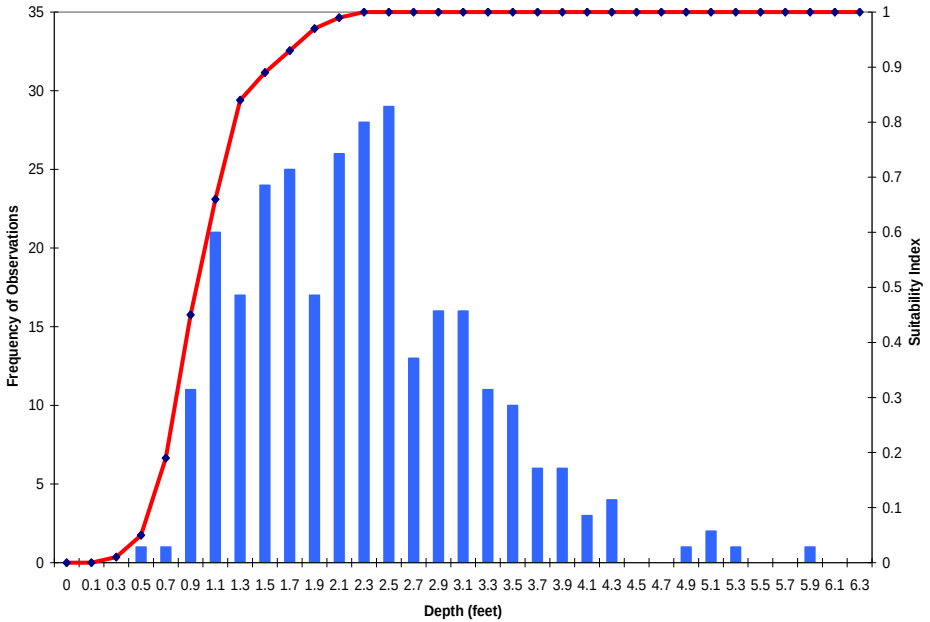


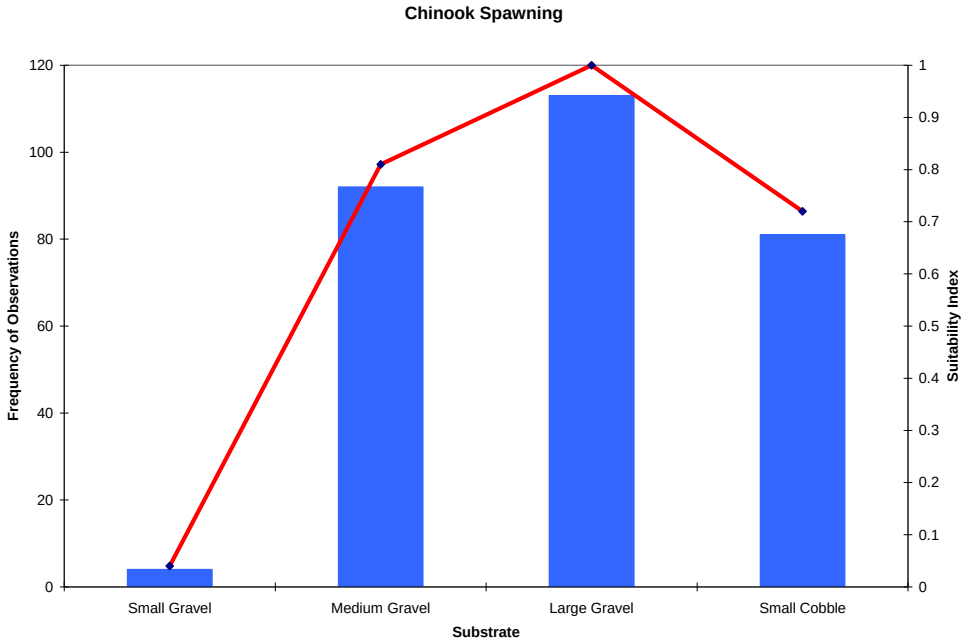
Conceptual Habitat Model Development for Chinook Spawning and Fry

- Chinook Spawning
  - Depth, Velocity, and Substrate
  - $(Depth_{SI} * Velocity_{SI} * Substrate_{SI})^{1/3}$
- Chinook Fry
  - $(Depth_{SI} * Velocity_{SI} * Cover_{SI})^{1/3}$ * Cover_Type_Modifier
    - Cover_Type_Modifier
      - 1.0 if vegetation
      - 0.17 is substrate
    - If Node > 2.0 feet from cover and/or Cover Depth < 0.4 feet then cell is not suitable

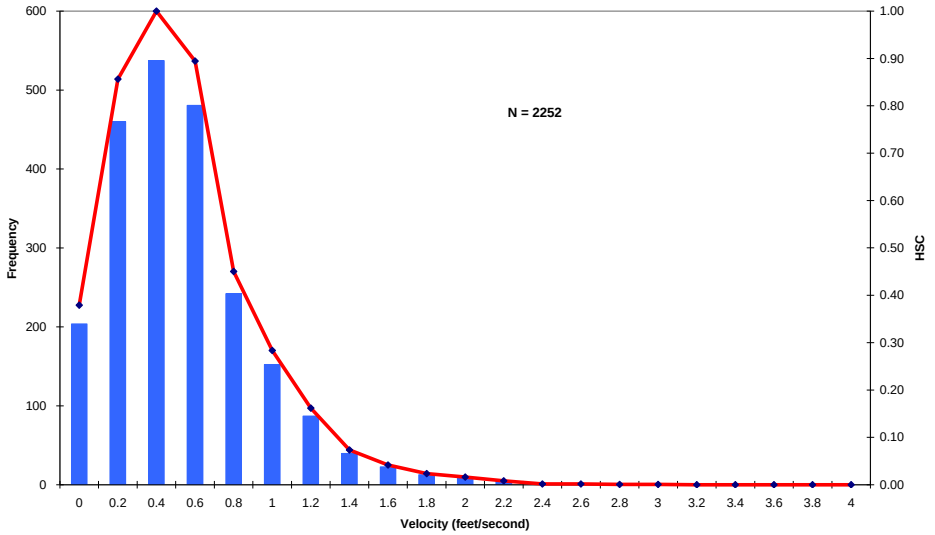
Chinook – Spawning Habitat Suitability Criteria

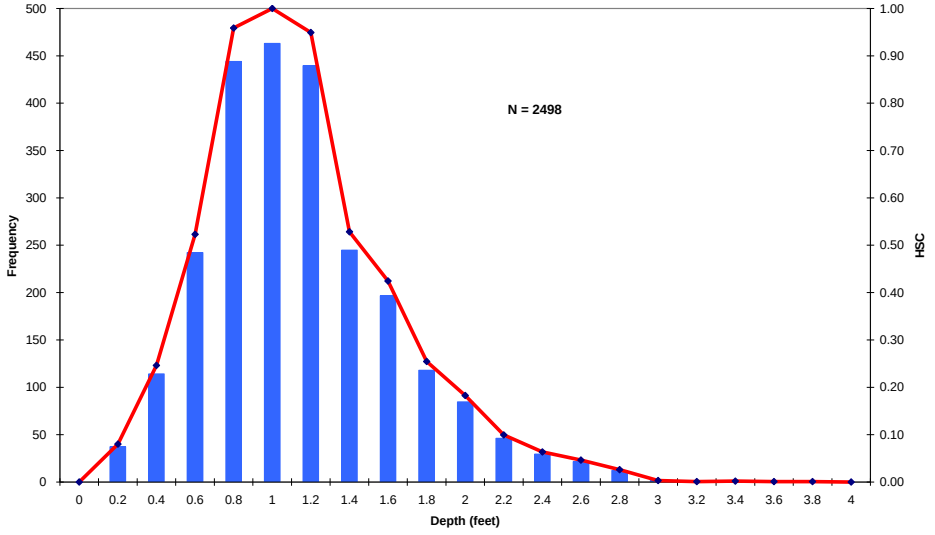


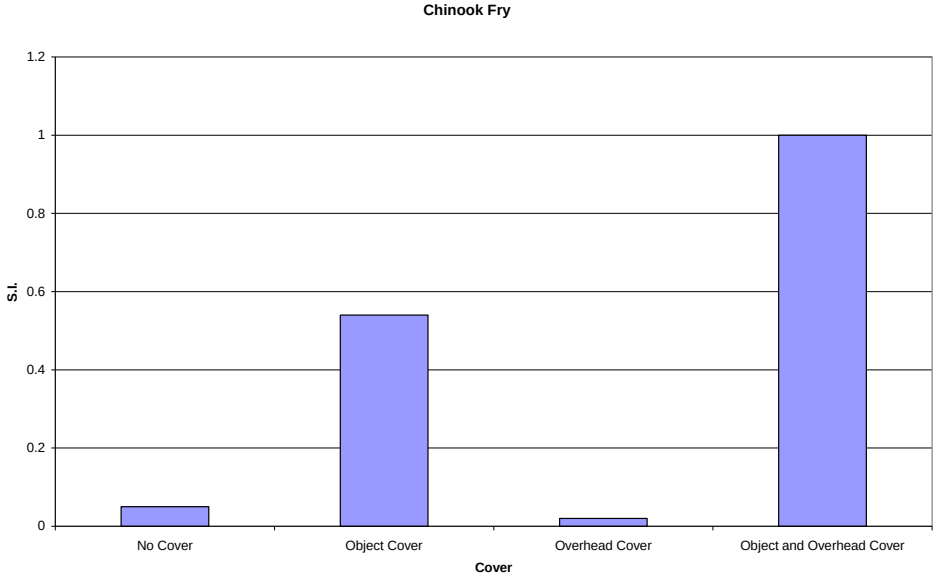


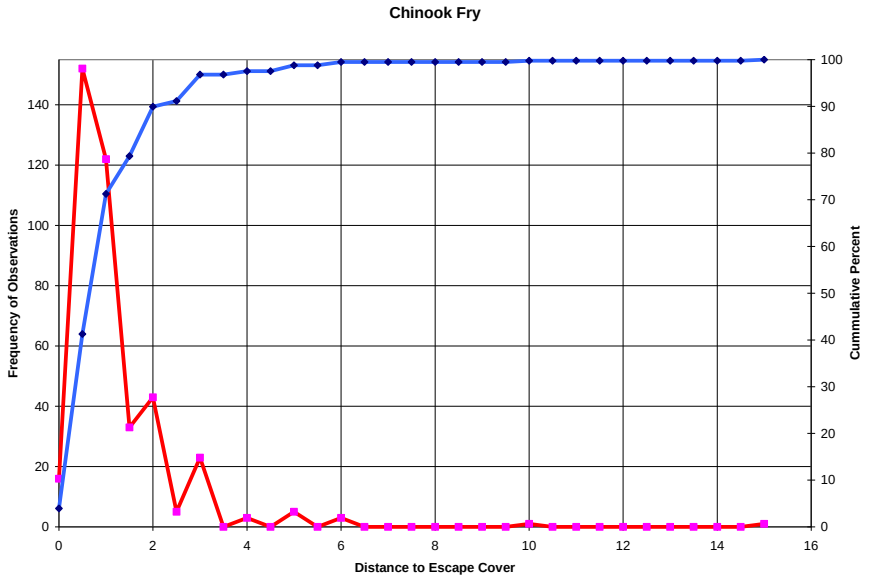


Chinook - Fry


Chinook Fry <55mm
N = 2252
Frequency
HSC
Velocity (feet/second)


Chinook Fry <55mm
N = 2498
Frequency
HSC
Depth (feet)

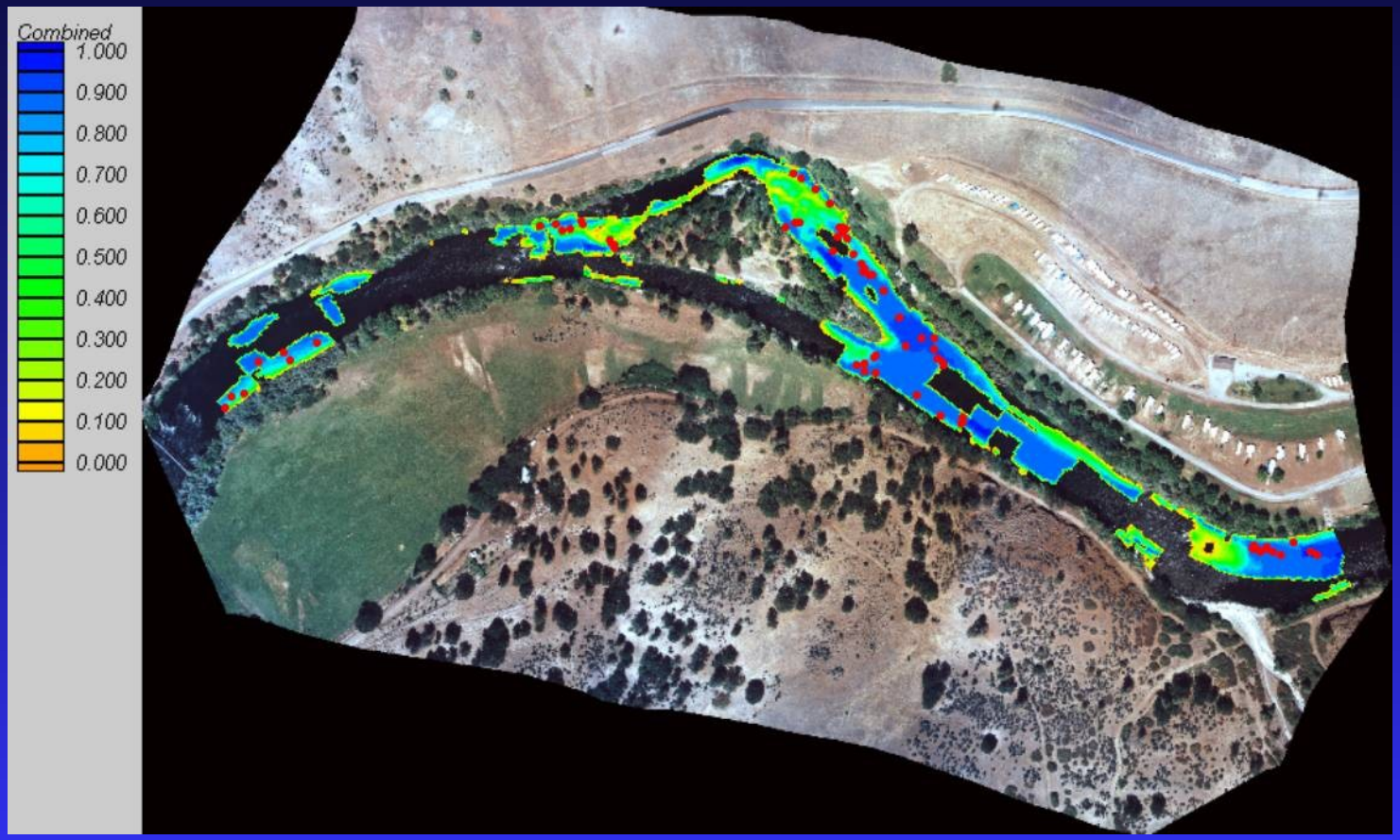

Chinook Fry
S.I.
No Cover
Object Cover
Overhead Cover
Object and Overhead Cover
Cover


Chinook Fry
Frequency of Observations
Cummulative Percent
Distance to Escape Cover

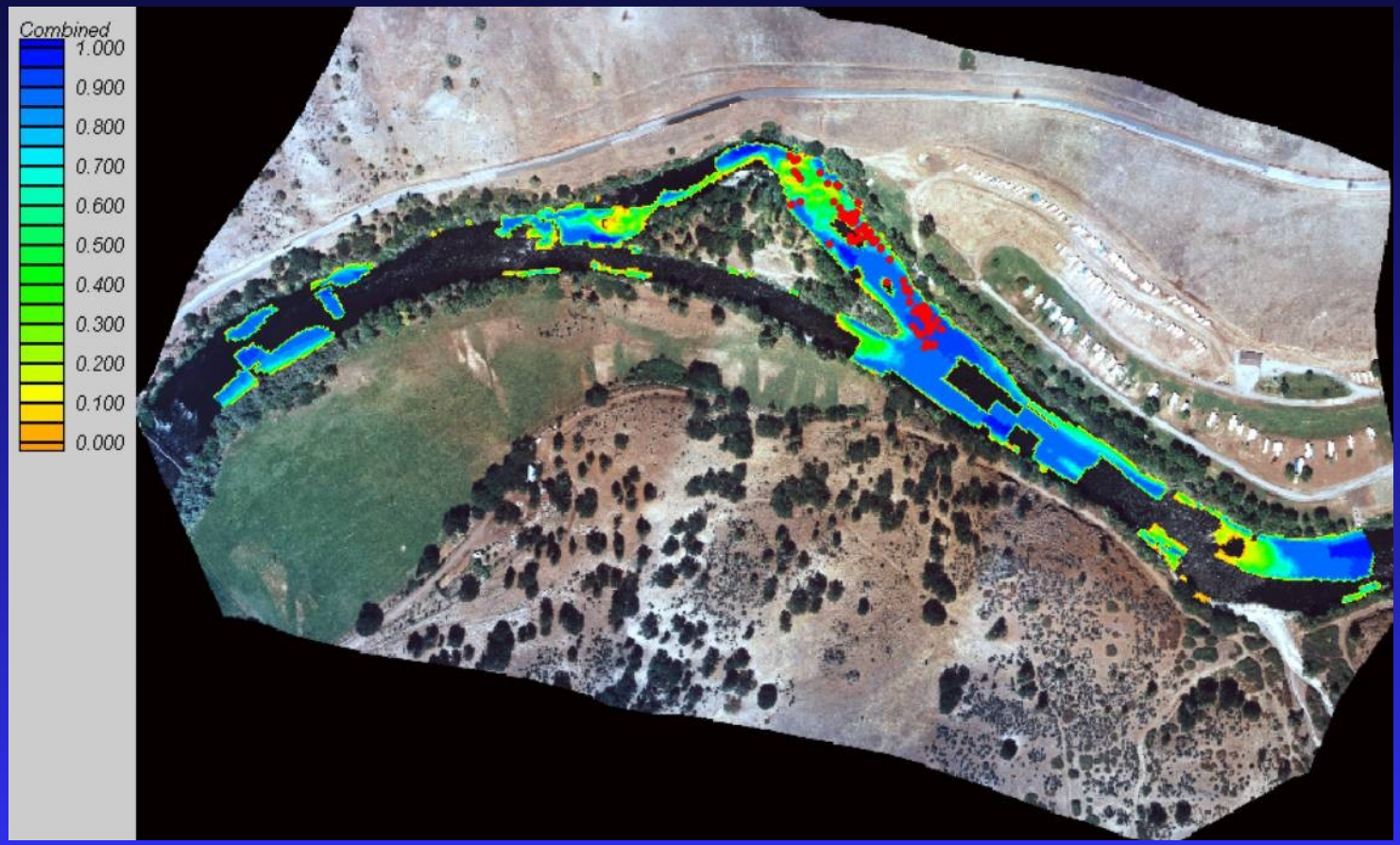
Field Validation of Habitat Modeling Results

- Habitat Suitability was Computed for Each Node for a Target Life Stage at Flow Rates when Fish were Sampled
- The Spatial Distribution of Suitable Habitat were Compared to Surveyed Life Stage Locations
- This was Repeated at Different Flow Rates (different years) and Different Study Sites

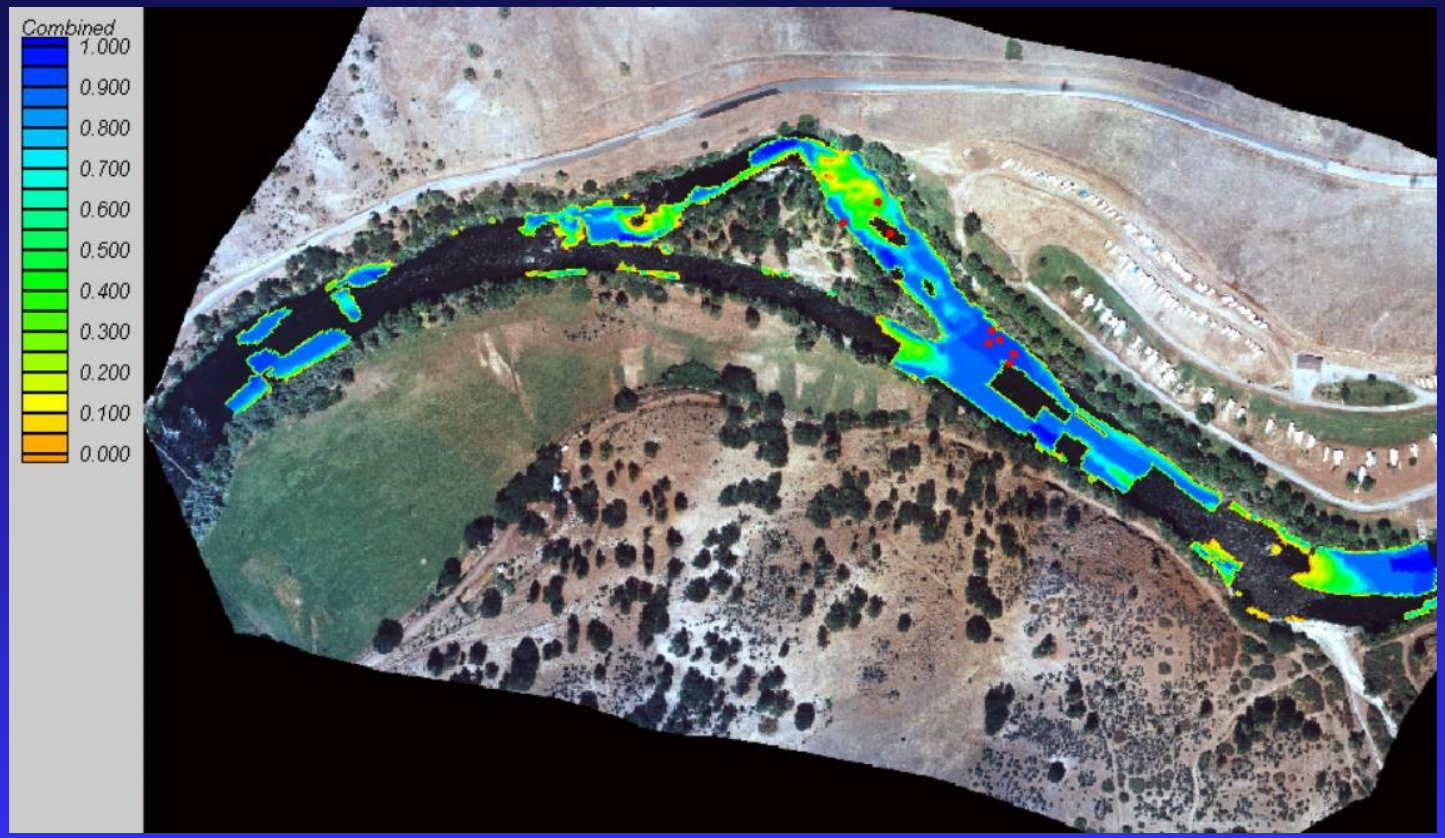
R-Ranch Study Site
Chinook Spawning – 1300 cfs



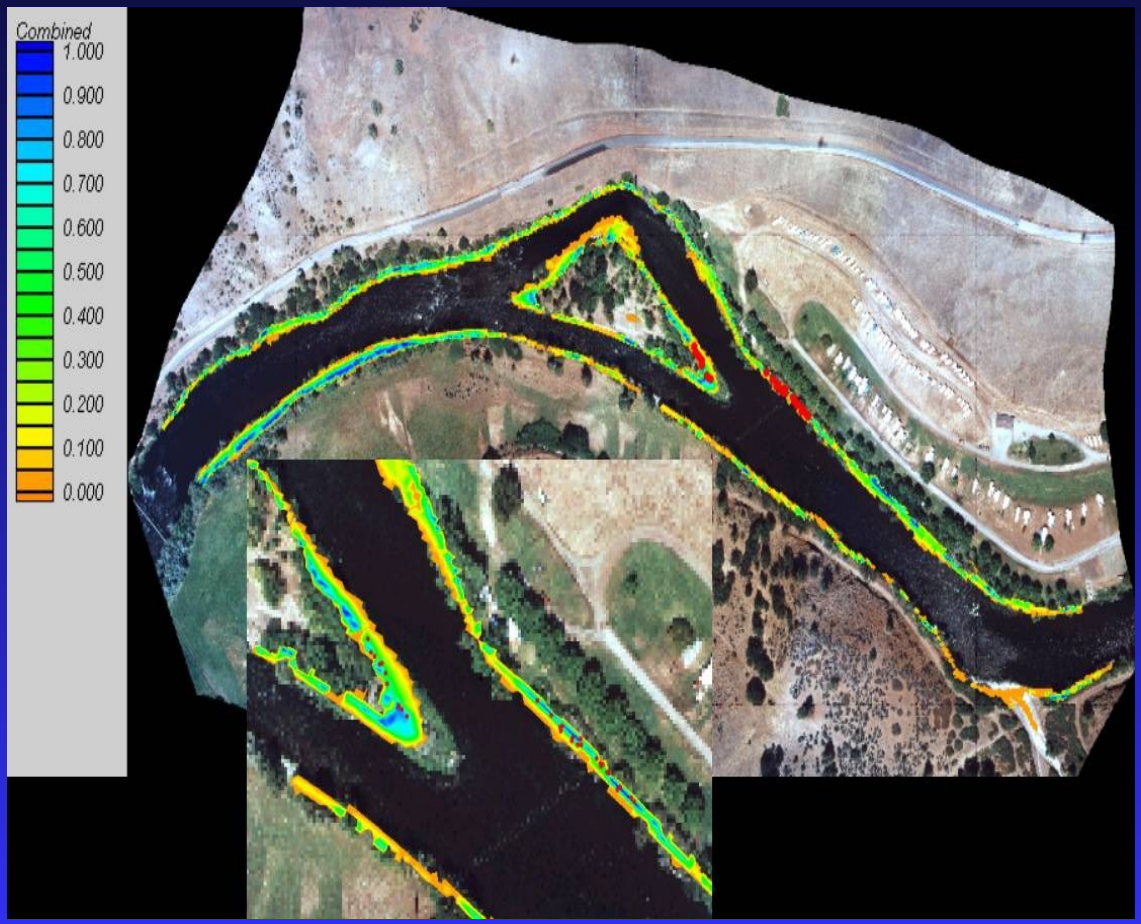
R-Ranch Study Site Chinook Spawning – 1377 cfs



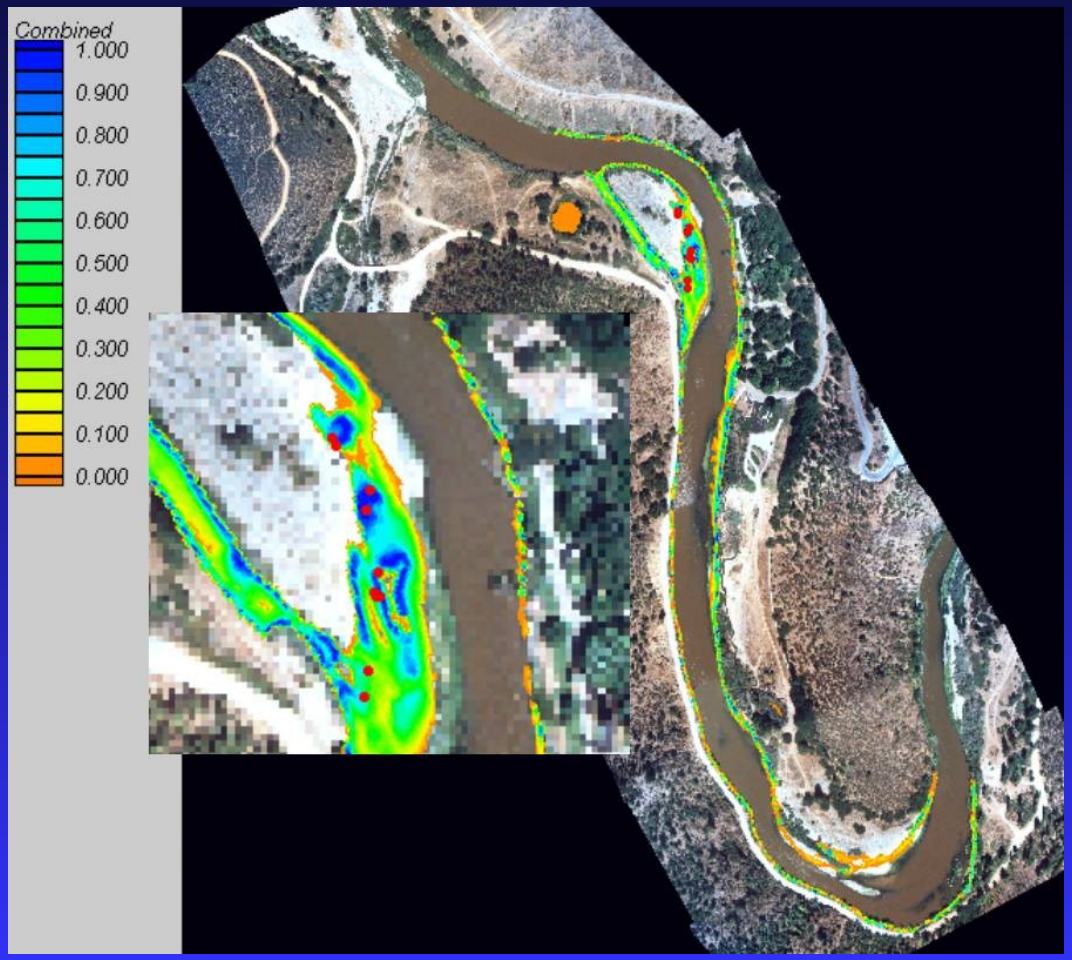
R-Ranch Study Site Chinook Spawning – 1765 cfs



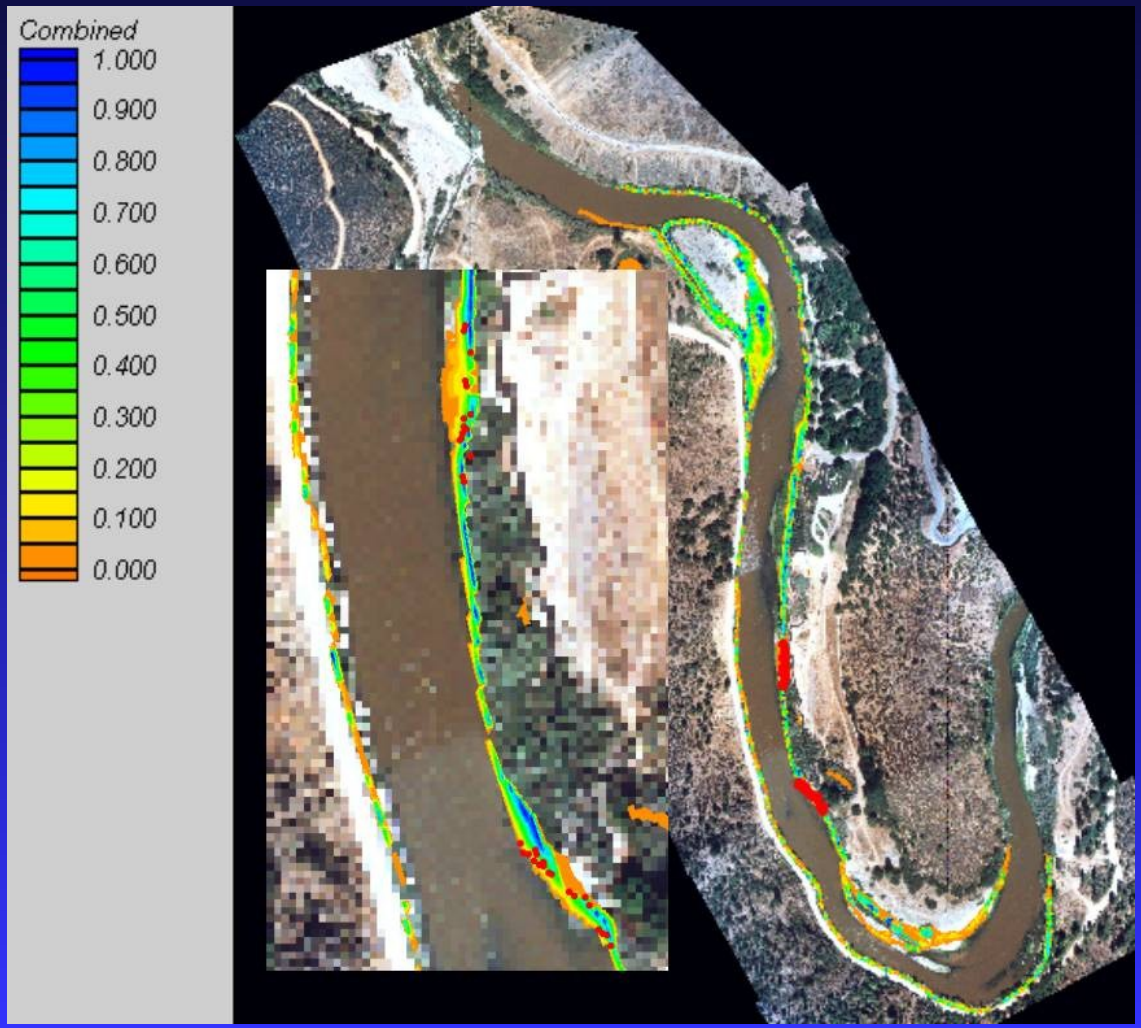
R-Ranch Study Site Chinook Fry – 5230 cfs



Trees of Heaven Study Site
Chinook Fry – 5190 cfs



Trees of Heaven Study Site
Chinook Fry – 6000 cfs



Conclusions

- Fish Observation Data for Spawning and Fry Life Stages of Chinook at Different Flow Rates Agree with Modeling Results:
  - Spatial Distribution of Physical Habitat
  - Model Results were Consistent between
    - Stations
    - Years
    - Flow Rates

Conclusions (continued)

- Collection of Field Observations on Fish Location was Critical to Validate Habitat Modeling Approaches for each Species and Life Stage
- Validation of Habitat Modeling Results is a Critical Step to Document the Scientific Defensibility of Instream Flow Studies

Researchers have already cast much doubt on the subject and if they continue their studies we shall soon know nothing at all.

Mark Twain