

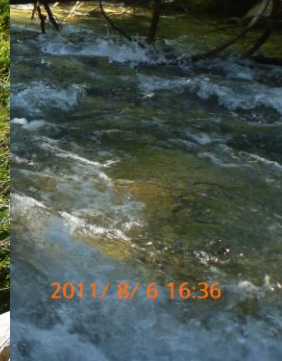
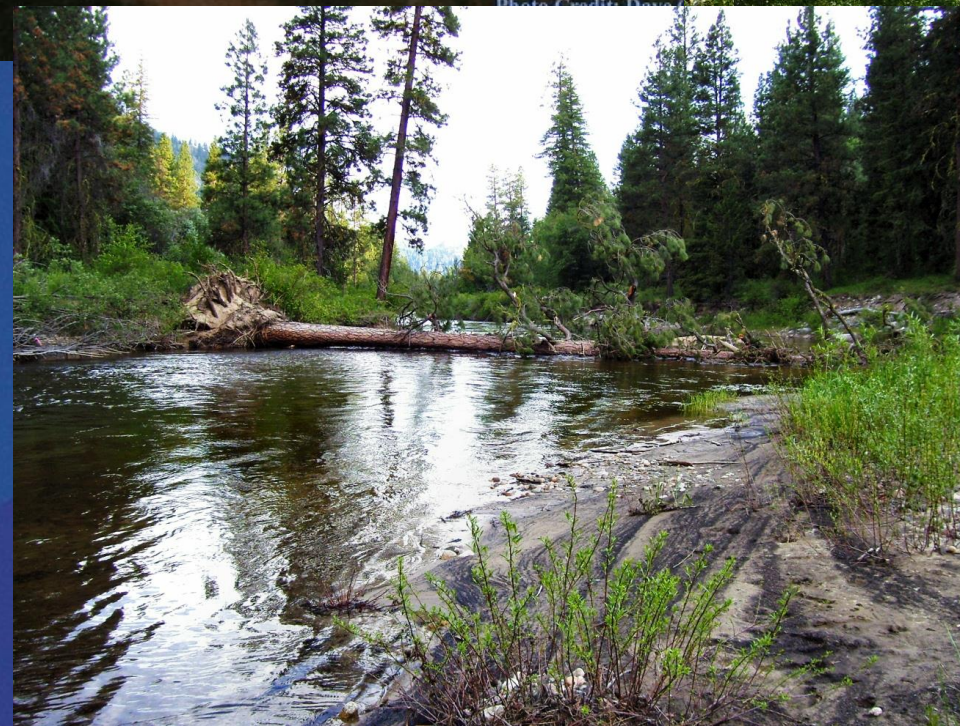


Fish – Habitat Models

December 4, 2013

Kevin See, QCI

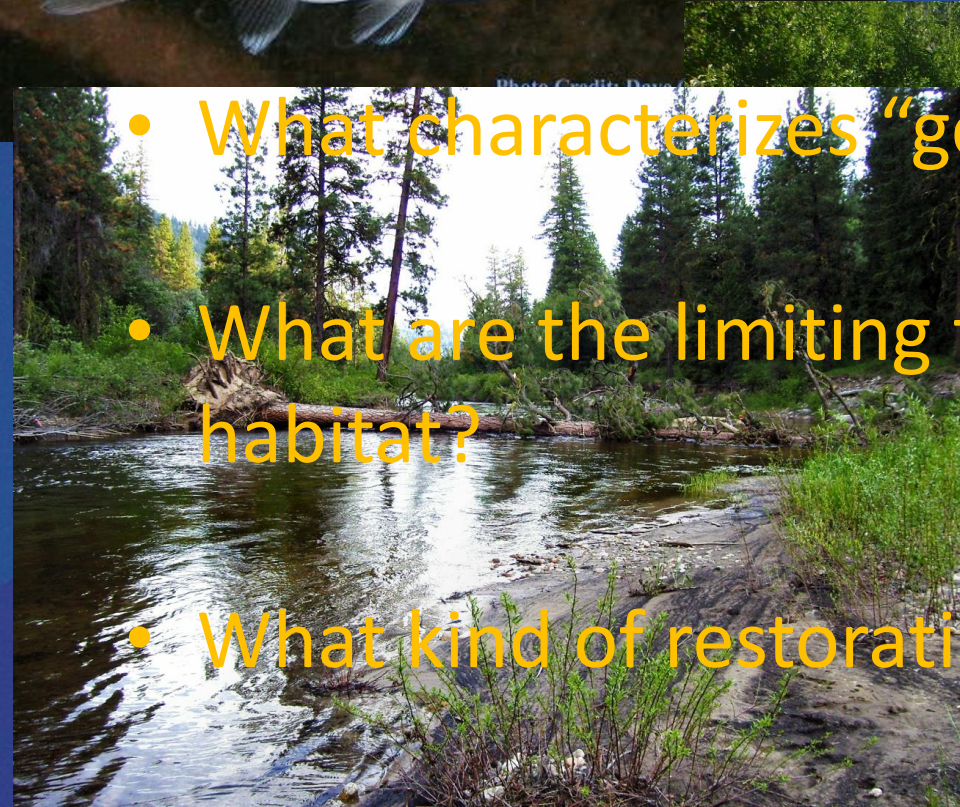
Fish Habitat Modeling



Fish Habitat Modeling



- What characterizes “good” habitat for fish?
- What are the limiting factors of a particular habitat?
- What kind of restoration should be done?



Deliverables

From CHaMP Report

- By **November 2013**: Continue progress on existing fish-habitat models and develop additional models (see the remainder of this Chapter for details on individual models).
- By **December 2013**: Assemble working data set of three years of CHaMP habitat and ISEMP fish data at sites.
- By **April 2014**: Develop a draft of the July 2014 synthesis report using the final QA/QC'ed data set of habitat and fish data.
- By **July 2014**: A synthesis of fish-habitat relationship results from the first three years of CHaMP habitat and ISEMP fish data collection. This synthesis will incorporate a landscape-scale extrapolation process in which habitat quality and quantity estimates are also projected to both CHaMP and non-CHaMP watersheds where fish and habitat sampling did not occur.
 - Provide a working version of all models including: unstructured correlations (BRT, etc.), structured correlations (habitat suitability indices, structural equations), and mechanistic models (ecohydraulics models). Provide these models in the form of interpretive tools that can be used by decision makers to derive answers for, in particular, the three KMQs listed on page 3.
- From **2014 – 2018**: Update the working version of all models with new information if/as it becomes available.
- By **2018**: Final product for inclusion in BiOp reporting summarizing/compiling each of ISEMP/CHaMP's fish-habitat investigative threads including unstructured correlations, structured correlations, and mechanistic models. Preliminary results from IMW's will also be included.

Unstructured Fish – Habitat Correlation Models



- Boosted Regression Trees



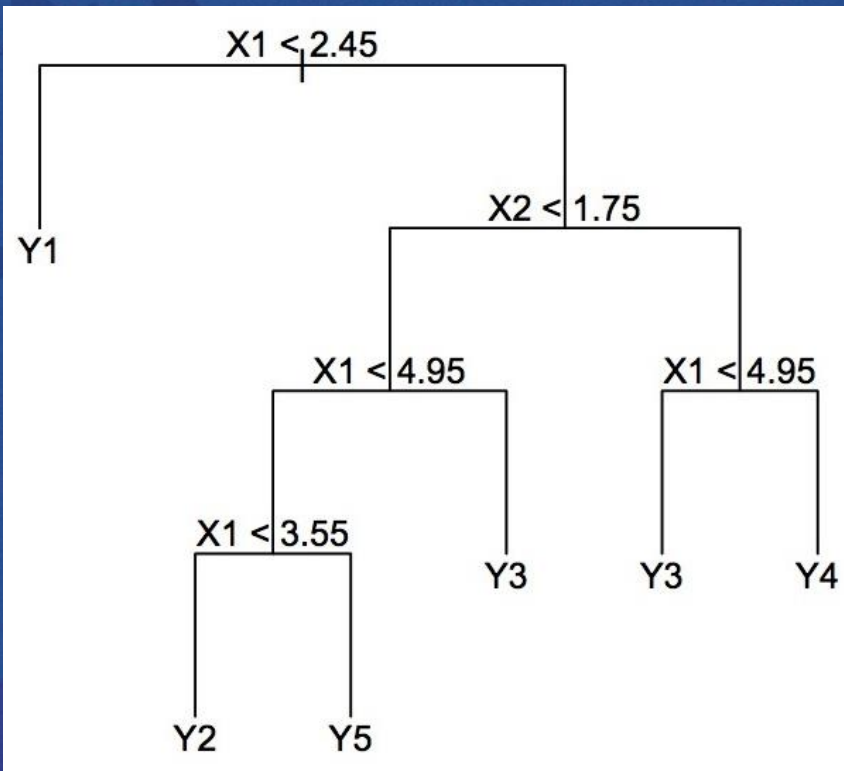
- Structural Equation Models

- Hierarchical Generalized Linear Models



Boosted Regression Trees

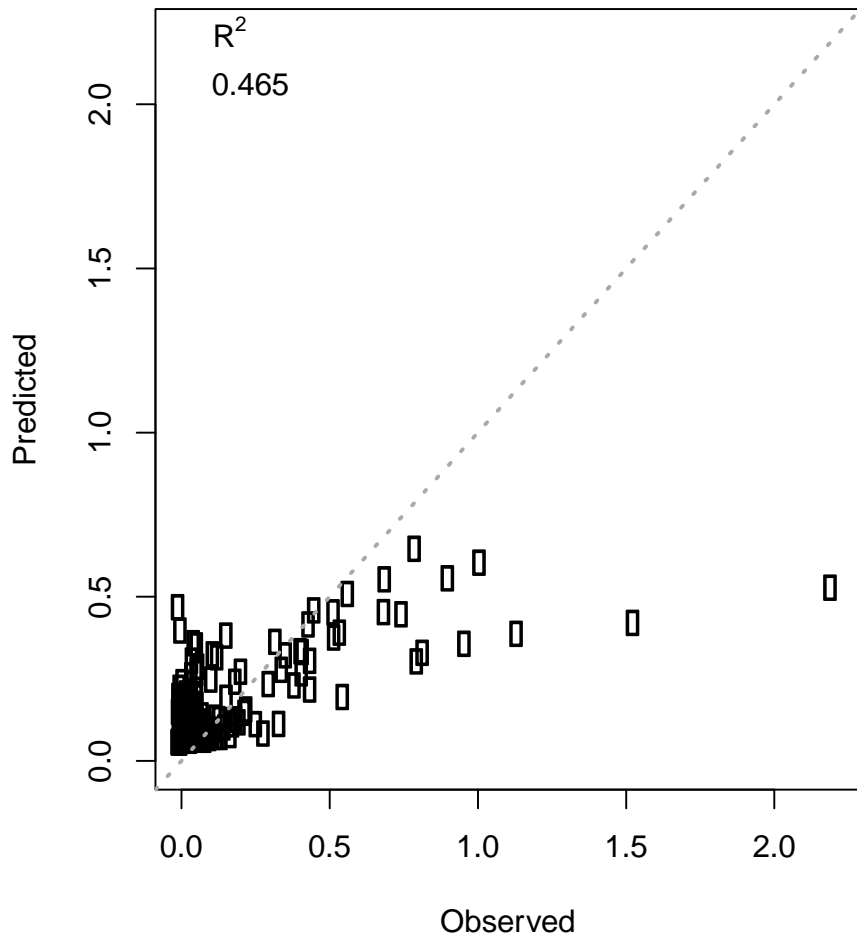
Classification And Regression Tree



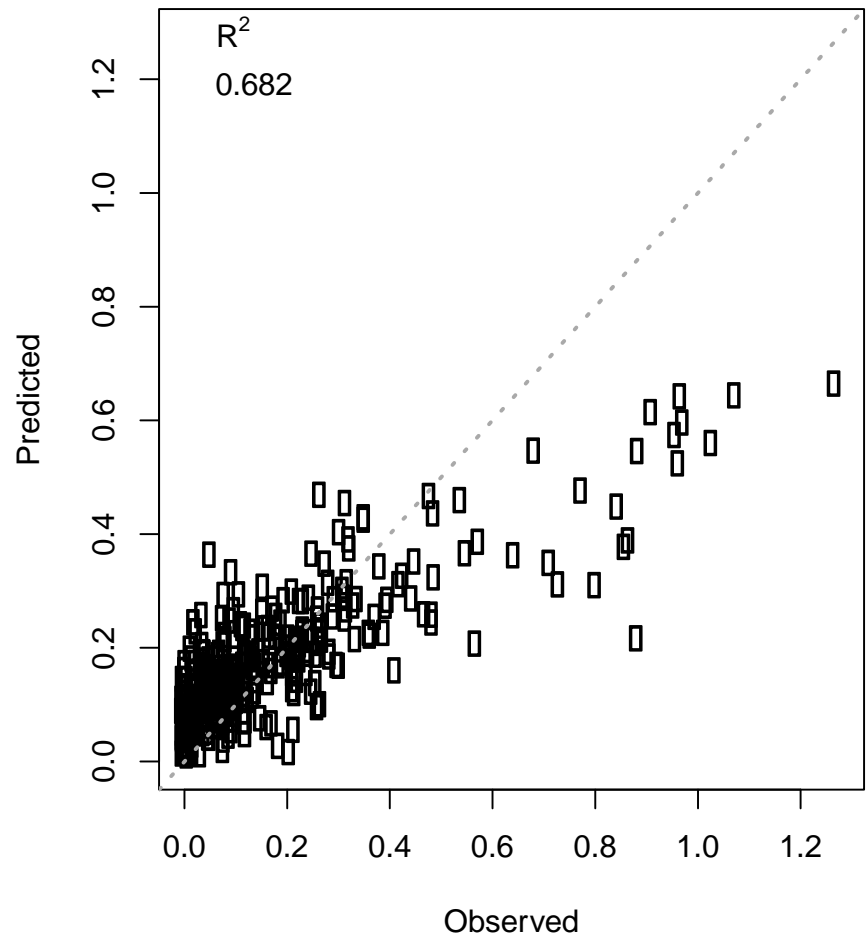
- No distributional assumptions
- Naturally incorporates predictor interactions
- Deals with outliers well
- Data is untransformed
- Can calculate relative importance
- Can do variable selection
- *Fit using R package "gbm"*

BRT Results 2011-2012

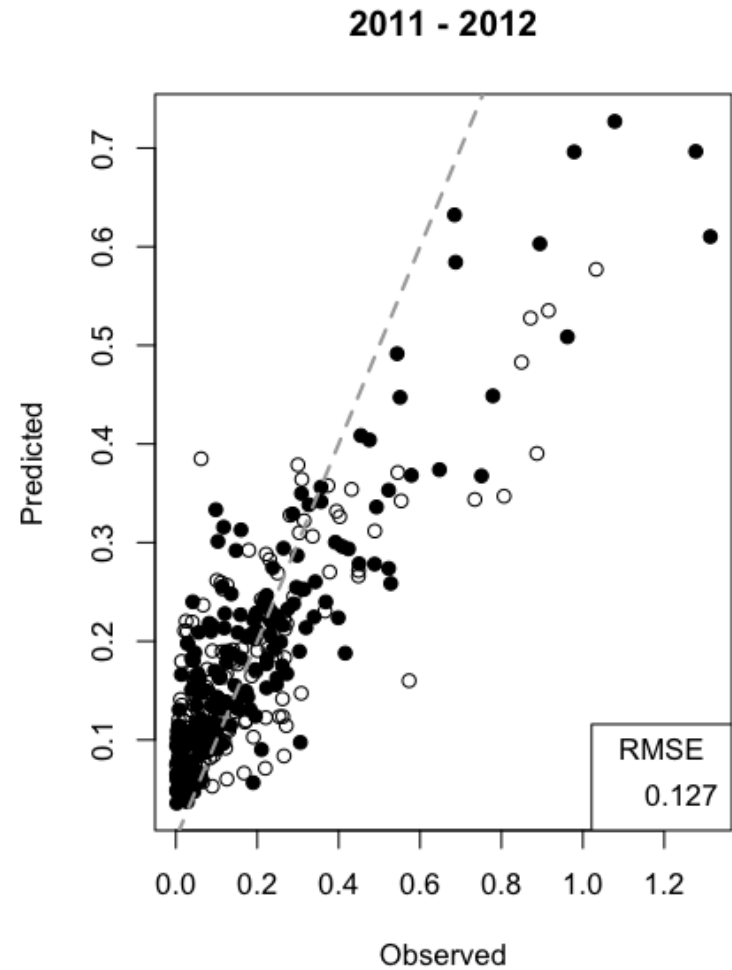
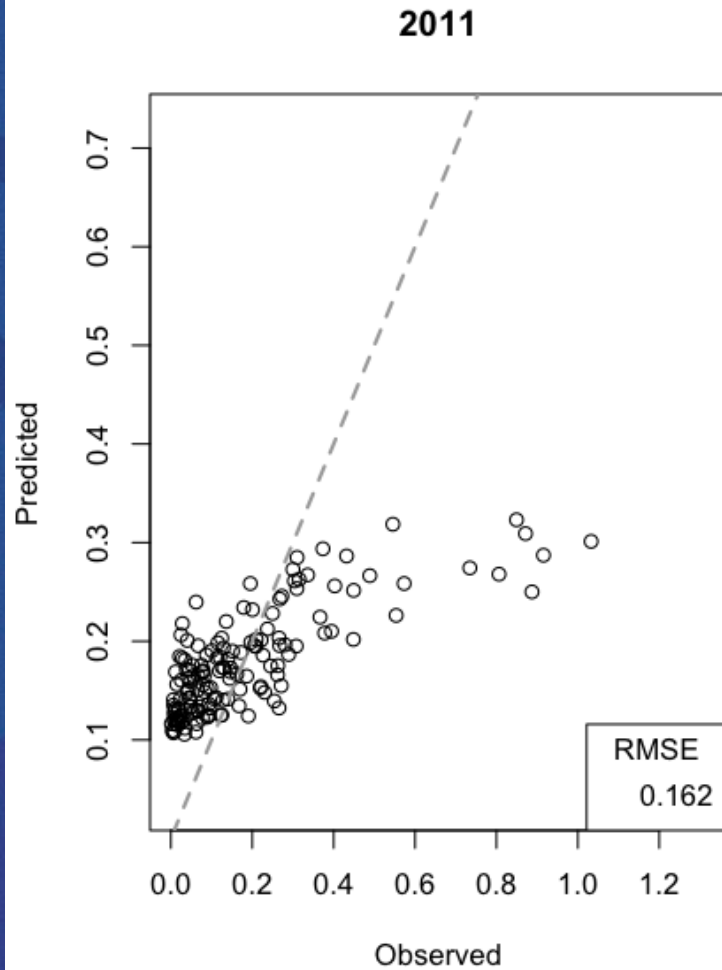
Chinook



Steelhead

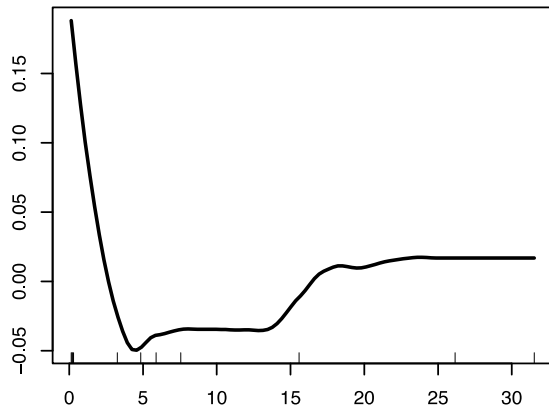


BRT Results 2011-2012

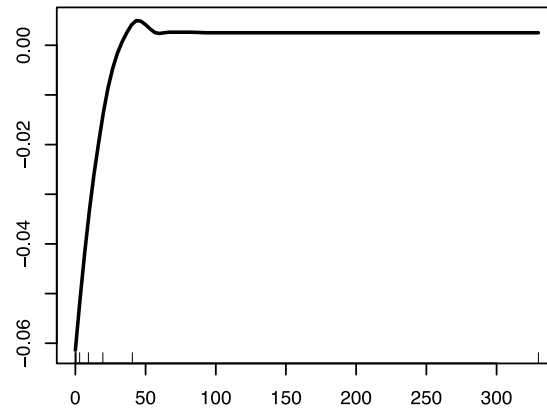


BRT Results 2011-2012

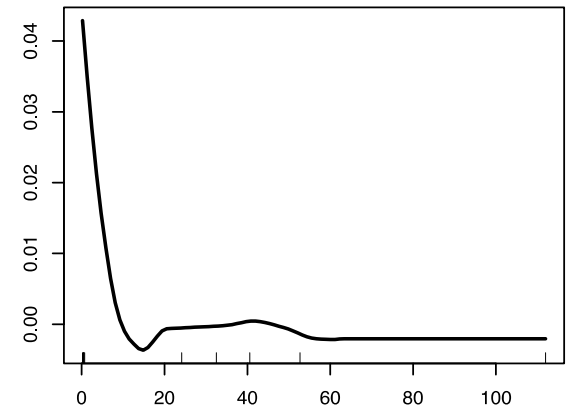
Chinook



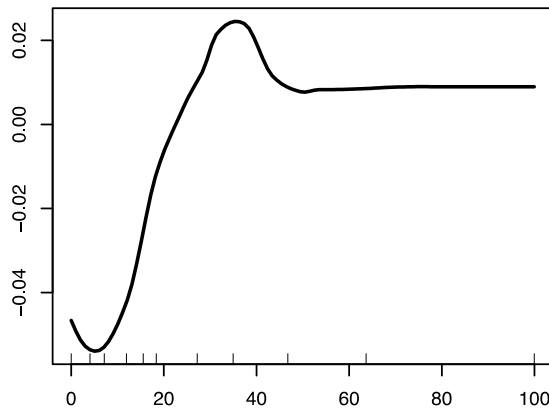
Spawner Density (34.8%)



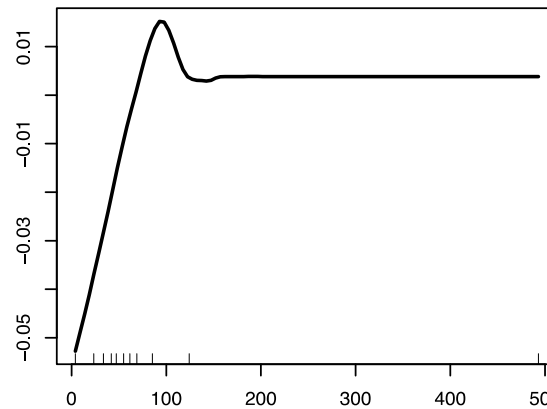
Large Wood in Pools (17.7%)



Variability of Width : Depth (17%)



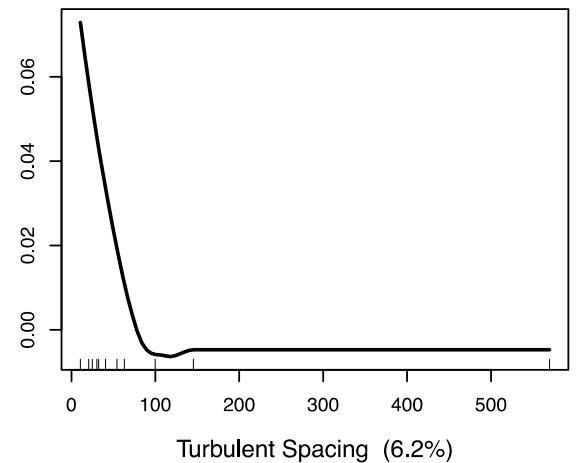
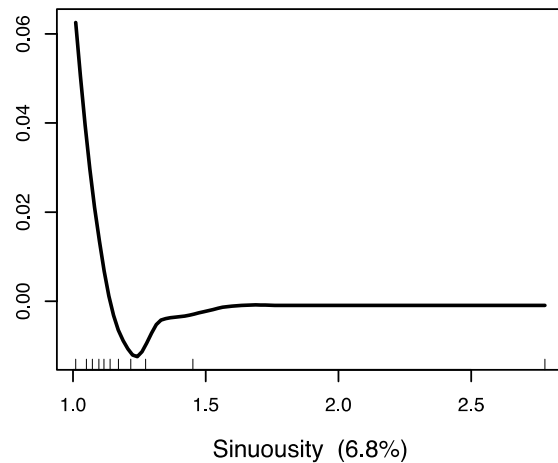
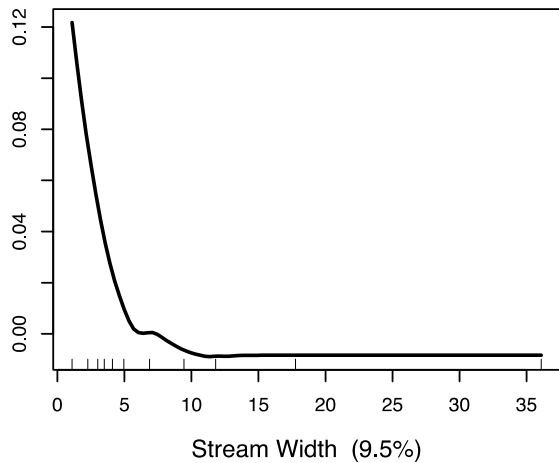
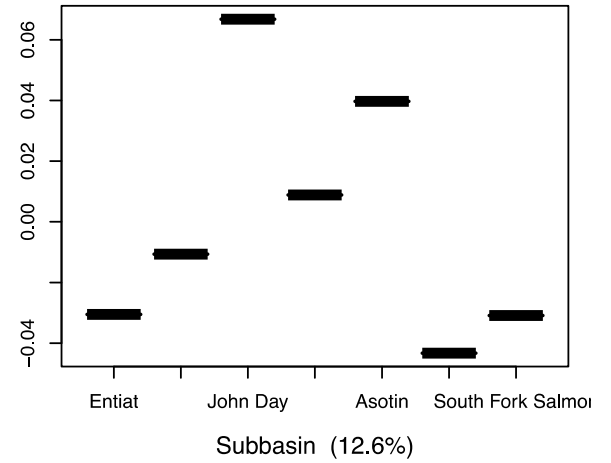
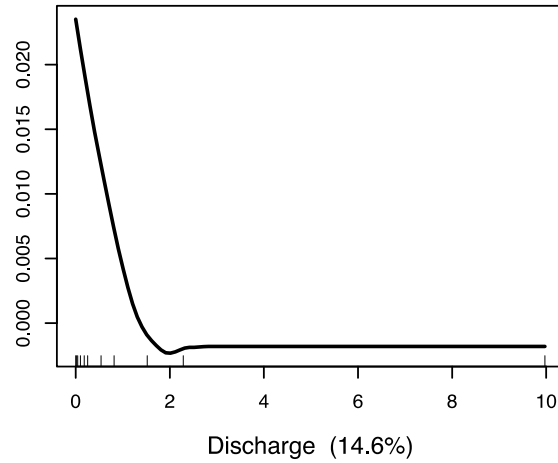
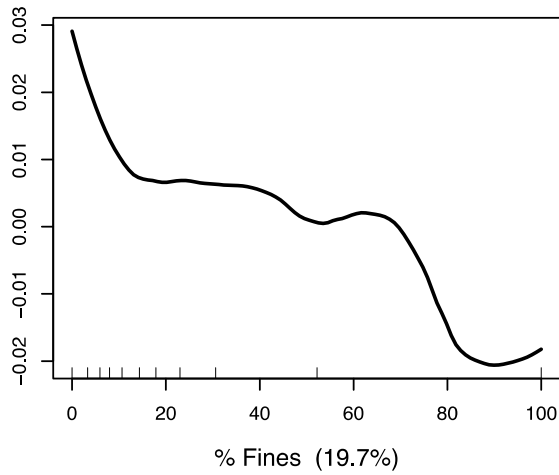
% Pools (16.1%)



D50 (14.4%)

BRT Results 2011-2012

Steelhead



Data Compilation - Fish

- 2011 & 2012 fish data is compiled
 - Abundance has been estimated at the site level (~620 sites)
- 2013: some fish data is compiled
 - Upper Columbia (Wenatchee & Entiat)
 - John Day (ELR & ODFW)
- The rest should be ready soon
 - Upper Grande Ronde: waiting for CHaMP metrics
 - Asotin:
 - SFS & Lemhi: technical issues with database almost resolved
- Abundance estimates should be done by end of December
- Considering normalizing fish densities by subbasin & year

Data Compilation - Habitat

- CHaMP metrics will be QA'd by ...
- Model should be improved by adding:
 - Temperature
 - Summer solar access
 - Drift?

Data Compilation - Temperature

- Temperature metrics will be ready for all ISEMP / CHaMP sites by end of December
- Probably focused on:
 - Mean of daily summer mean temp
 - Summer Growing Degree Days (sum of degrees from May 1 – Sept 22)
 - Max of 7-day running mean temp
 - Max of 7-day running max temp

Plan of Attack

- Use BRT as data exploratory model
 - Determine what metrics contain the most information about fish
 - Can also use BRT results to quantify “habitat quality”
- Use metrics with most information in a more mechanistic model (SEM, etc.) to explore the causality of the fish / habitat relationship

Questions for Discussion

- Fish / m²

- Are fish sampled over CHaMP's Site.Wetted.Area?
- What about side channels?

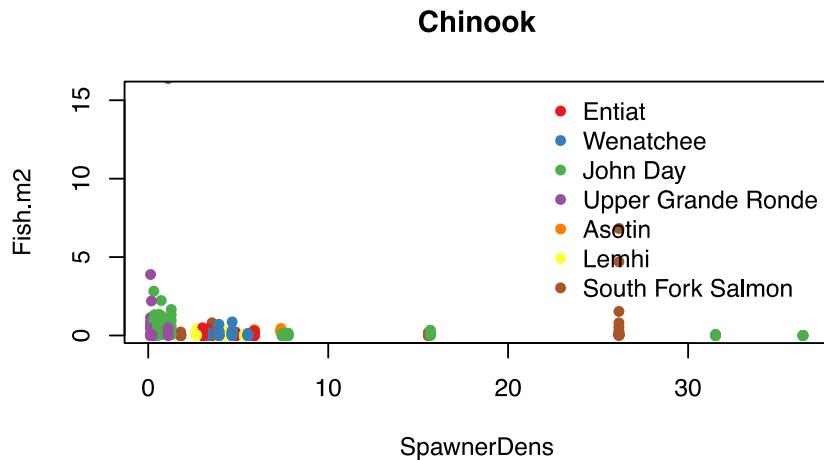
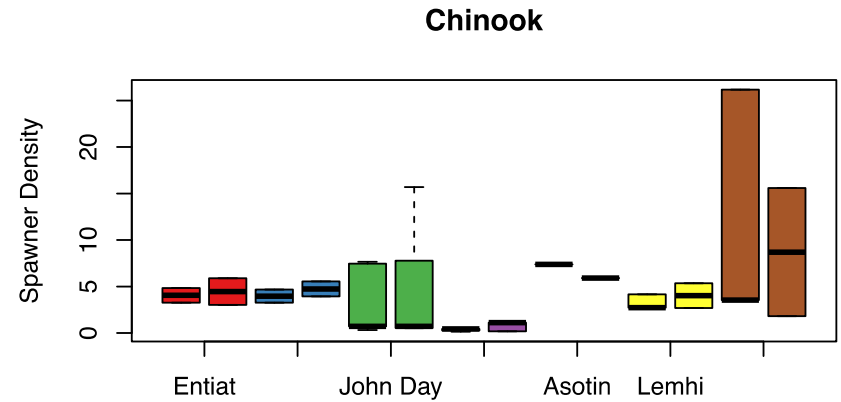
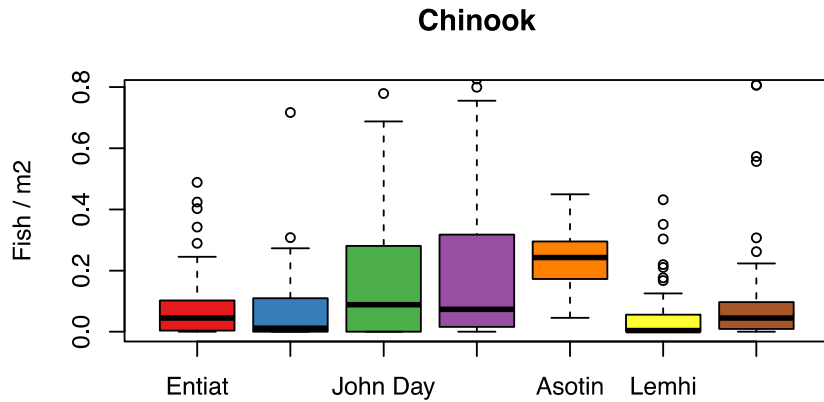
- Consider normalizing fish densities within a subbasin / year

- Do away with need spawner densities

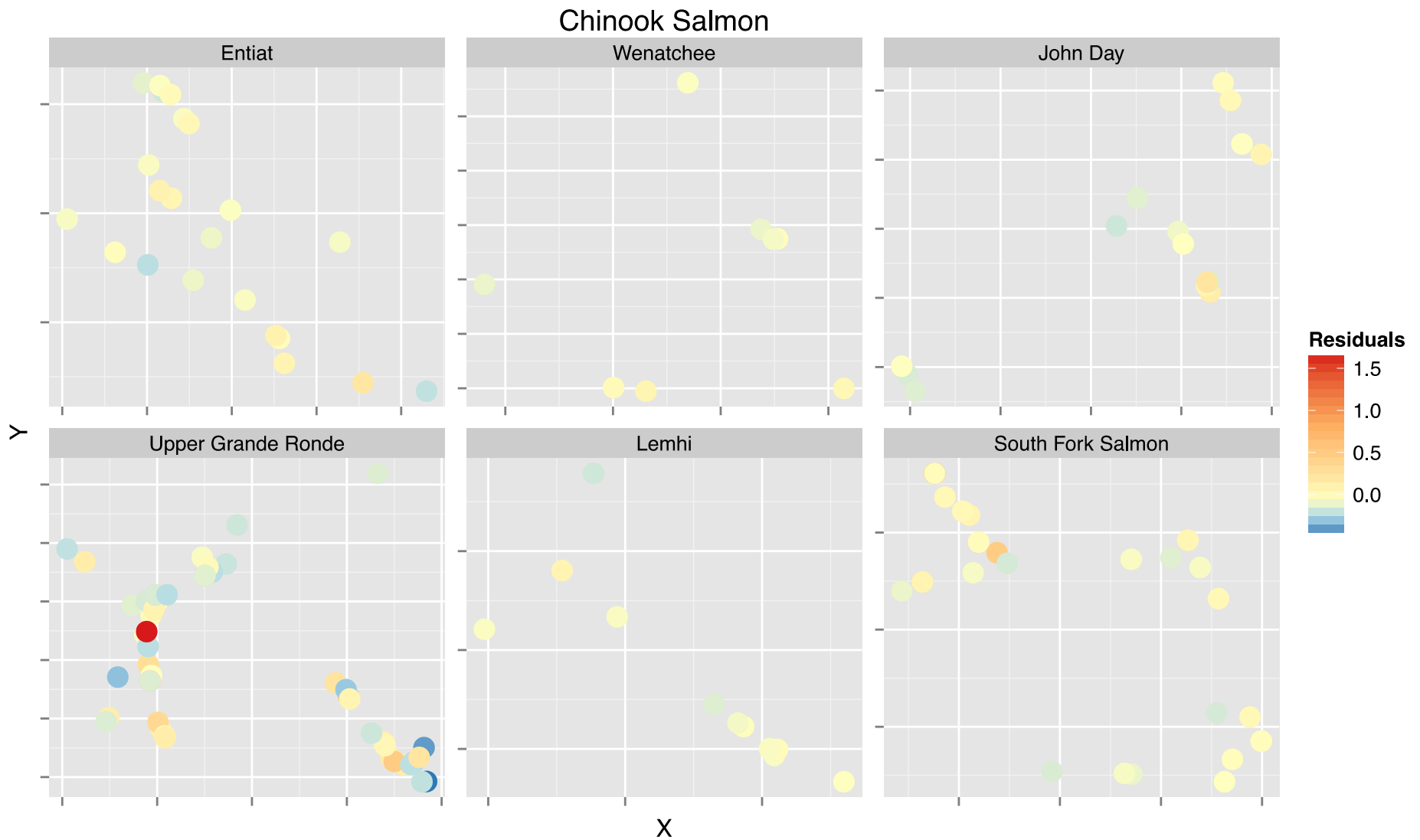
The End ...



Issues with Spawner Density



Mapping Residuals - Chinook



Mapping Residuals - Steelhead

